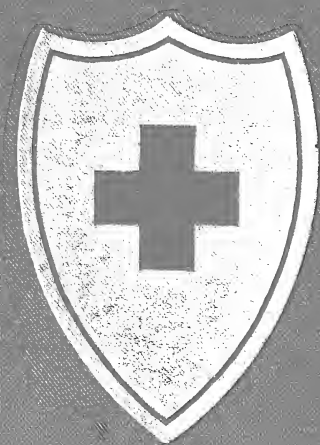


# AMBULANCE WORK



R. LAWTON ROBERTS, M.D.

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ON  
AMBULANCE WORK







TRIANGULAR BANDAGE  
(After Lemercier)

## ST. JOHN AMBULANCE ASSOCIATION

### FRONTISPIECE.

*Illustrated Triangular Bandage of the St. John Ambulance Association.*

*These Bandages, with printed instructions enclosed, can be had for 6d. each, or post free, 8d. each, on application to the Hon. Director of Stores, St. John's Gate, Clerkenwell, London, E.C.1.*

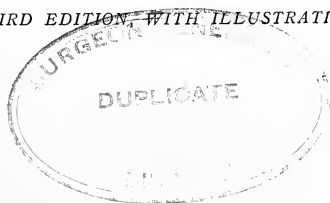
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BY  
R. LAWTON ROBERTS, M.D. <sup>e</sup>

MEMBER OF THE ROYAL COLLEGE OF SURGEONS, ENG.;  
HONORARY LIFE MEMBER OF, AND LECTURER AND EXAMINER TO, THE ST. JOHN  
AMBULANCE ASSOCIATION

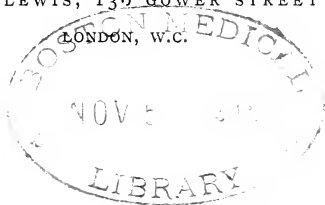
THIRD EDITION, WITH ILLUSTRATIONS



LONDON  
H. K. LEWIS, 136 GOWER STREET, W.C.  
1888

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LONDON, W.C.





TO  
SAMUEL NOBLE BRUCE, Esq., M.R.C.S.

THIS LITTLE BOOK IS DEDICATED  
AS A TRIBUTE OF LONG PERSONAL FRIENDSHIP,  
AND IN REMEMBRANCE OF MANY VALUABLE SERVICES AND  
MUCH KINDNESS RECEIVED,

BY  
*THE AUTHOR*



## PREFACE TO THIRD EDITION.

---

A LARGE edition having become exhausted, this book is re-issued, with fifteen fresh illustrations, and an Appendix containing such additional information as is rendered necessary by the recent developments of Ambulance work. During the last two years, the ambulance movement has spread with marvellous rapidity, both at home and abroad, and its importance has become more than ever recognized.

This is very noticeable in connection with our *Collieries and Mines*. The Royal Commission on Accidents in Mines suggested (March, 1886) that measures should be adopted for dealing more systematically and expeditiously with accidents in mines, that ambulances and stretchers should be kept in all mines, that in mining districts arrangements should be made for the establishment of ambulance centres, and that facilities should be afforded for the instruction of men in First Aid and the use of First Aid Appliances. In the Coal Mines Regulation Act (1887), it is ruled that "Where persons are employed underground, ambulances or stretchers, with splints and bandages, shall be kept at the mine ready for immediate use in case of accident." Surgeon-Major Hutton, acting under instruction from St. John's Gate, conducted an "Ambulance Crusade" in the County of Durham and a portion of Northumberland, during which (from September 23rd to November 2nd, 1887) he addressed twenty-

four public meetings, and held innumerable private interviews and conferences in furtherance of the good work. The main features of Surgeon-Major Hutton's addresses deserve notice. He directed attention to the suggestions of the Royal Commission on Accidents in Mines, and to the rule concerning stretchers, etc., in the Coal Mines Regulation Act, and explained that neither the Government, nor the Owners or Managers of Mines, possessed means or organization by which such suggestions and rules could be practically carried out. The St. John Ambulance Association, he urged, was the only body in the country which could successfully carry out the work, for it was both able and willing to supply all the necessary ambulance plant (or *matériel*) as well as to provide for the instruction of the men in First Aid. The benefit of becoming attached to a great central association (such as the St. John Ambulance Association) which was represented all over Great Britain and also throughout the British Possessions abroad was fully dwelt upon, as conducing to uniformity of instruction—"Men instructed in one place when they migrated to another were almost sure to meet St. John Ambulance men, and they understood each other at once in moving injured patients;" and, moreover, the due carrying out of the work "could not but tend to (1) a reduction of the death-rate in mines; (2) a reduction of sickness and injury and length of time on the sick-list; (3) resulting in increase to the wages earned by the mining class and saving of funds of their provident societies." It was further suggested that "detached classes" would answer best in the colliery districts, such classes being "under the eye of the manager, who was responsible for the proper working of the

mine—The colliery officials being the first to attend the instruction.”

These points, which are quoted from Surgeon-Major Hutton's addresses, are applicable to many other classes of the community as well as miners. As for the “Crusade” itself—the first, I hope, of a series—it proved a very remarkable incident in the work of the Association, whether one considers the enthusiasm of the crowded meetings, the great results as shown by the successful development of Ambulance Work in the Northern counties, or the indefatigable energy of Surgeon-Major Hutton who, in the prosecution of his humanitarian labours, “laid it down, as a rule, that the word *difficulty* had not to enter into the ambulance vocabulary.”

It is very gratifying to know, from the St. John Ambulance Association Annual Report (1887) that, “both at the home and colonial centres, the absolute necessity that *all police officers, of whatever force or grade*, should possess the knowledge of how to render first aid, is fast becoming daily more and more recognised by the various corporate and other bodies charged with their administration;” and in connection with this matter, one can fully appreciate the statement of the Chief Constable of Nottingham that “no special services performed by the police have brought them so much in pleasant touch with the public.” In the same Annual Report, it is noted that the “interest taken in Ambulance work, by *railway employés of all grades* is not only maintained, but even steadily gaining ground.” If any confirmation of the above was needed, the Annual Report (1887) of the kindred Association of St. Andrew's abundantly supplies it; thus, the Report runs:—“The Central Executive (of St.

Andrew's Ambulance Association) are very anxious that all policemen and railway servants should be thoroughly trained in "First Aid," and, in addition to the classes reported on last year, they are glad to add that successful classes of the Perth policemen, of the policemen of Leith, the greater part of the Edinburgh City police, and of the Mid-Lothian and West-Lothian Constabulary, and the Glasgow and South-Western, North British, Caledonian, and Joint Lines Railway Servants have been conducted. Many instances might be recorded where the instruction given has been of the greatest service in saving life and mitigating suffering."

In like manner, first aid and the best methods of transport have been widely studied by people of other classes and occupations, such as *Firemen, Rifle Volunteers, Gas Employés, Athletes, Asylum attendants, Factory hands*, representatives—in short—of all portions of the community. And there is a natural tendency among those who hold certificates of proficiency in Ambulance work to associate themselves together into organized bodies, the *men* into *Local Ambulance Corps*, the *women* into *Nursing Guilds or Corps*, by which the Ambulance knowledge acquired can be maintained and methodically applied for the public good. These Corps are noticed in the Appendix, as is also the central *Invalid Transport Corps*—an organization for the easy conveyance of invalids (infectious cases only excepted) from one part of the kingdom to another, from this country abroad, and, when required, from European localities to England.

The value of Ambulance teaching is fully appreciated too by the *military* world, as is shown by the "regulations" enabling soldiers to "attend Ambulance classes held periodi-

cally by War Office order, in all garrison towns, and instructed by officers of the Army Medical Staff;" by the extension of the Volunteer Medical Staff Corps, divisions of which now exist at Edinburgh, Woolwich, Manchester, Maidstone, and Leeds, as well as in the Metropolis; and by the increase in number of Volunteer Regimental Ambulance Detachments, a good example of which is to be seen in the 1st Volunteer Battalion of the Derbyshire Regiment, and in many other provincial battalions. In connection with this subject, I find, from papers courteously forwarded to me by Dr. Lawrie Gentles, of Derby, that the *Volunteer Medical Association*\* hope, ere long, "to stimulate Ambulance work throughout the whole Volunteer force" by "lending Ambulance *matériel* to the various Regiments for Instruction purposes," and arranging for a "Challenge Shield, which shall be open to yearly competition by the various Volunteer Regiments in the United Kingdom—the shield to be held for the year by the Regiment of the winning Ambulance Detachment."

While preparing this edition, much valuable assistance has been cordially given me, in the form either of articles not otherwise obtainable, information on special points, or advice, by Major Sir Herbert C. Perrott, and Mr. John Furley, of St. John's Gate; Surgeon-Major Hutton, of Leamington; Dr. A. H. Jones, Northampton; Drs. Cassidi and Lawrie Gentles, of Derby; Mr. J. H. Buckley, Leicester; and Mr. Thomas Bell, H. M. Inspector of Mines.

Of the fifty-nine illustrations in the book, twenty-six (Figs. 8 to 33 inclusive) are obtained, with the permission of Messrs. Sampson Low and Co., from Esmarch's *Treatment of*

\* *Offices*:—26, King William Street, Strand, London, W.C.

*Wounded in War*; four others (Figs. 7, 41-3) are taken, with the sanction of Messrs. W. Clowes and Son, from Evatt's *Ambulance Organization, Equipment, and Transport*; the authorities at St. John's Gate have kindly allowed me to represent their "Illustrated Triangular Bandage," in the frontispiece; and I am indebted to the central committee of the St. Andrew's Ambulance Association for permission to publish diagrams of their "Illustrated Triangular Bandage," Stretcher, Wheeled Litter, Ambulance Waggon, and Knapsack of first aid appliances.

R. LAWTON ROBERTS, M.D.

RUABON, NORTH WALES,  
*September, 1888.*



## PREFACE TO SECOND EDITION.

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\* \* \* \* \*

I CANNOT omit to urge the necessity that exists for *universal instruction in Ambulance work*. In connection with active *military* service, the Public are aware that some kind of Ambulance arrangements are necessary; but they, as a whole, fail altogether to appreciate the degree of method, the vastness, and comprehensiveness essential to any Ambulance Organization which is designed to meet the requirements and stand the strain of a great war. "Nobody," as an eminent Military Surgeon said to me a little time ago, "knows anything of it." Yet the work of collecting the wounded and attending to their first wants, after an engagement, is described by an experienced authority on such subjects as a "vast and serious concern:" and on the way in which this duty is performed depends, in numerous instances, whether the sufferers rally from their hurts or rapidly succumb; and, in very many other cases, whether the wounded eventually recover to spend useful lives or, on the other hand, linger out a crippled and miserable existence. And this is by no means all, for there is the subsequent treatment and nursing of the wounded, day by day, and month by month, in localities where ordinary conveniences are absent, and clean water

and other necessities of life, it may be, difficult to obtain. Further, there is the work of conveying the patients, as circumstances permit, stage by stage, back by the route along which the army advanced; and here numerous obstacles are often encountered, such as the impracticable character of the country; the absence of anything like good roads; the scarcity of transport animals, horses, mules, camels, etc., suitable to the climate and ground; and the difficulty in procuring or improvising vehicles, or other means for conveying the wounded, which are alike suitable for the easy carriage of patients and adapted to the nature of the ground to be traversed. Moreover, it must be borne in mind that, over and above the wounded, there are always a considerable number of sick to be attended to. On an average, under favourable circumstances, during a ten days' march, as many as 1,440 to 1,800 of an Army Corps, 36,000 strong, require "hospital treatment;" and this number is greatly increased by bad weather, improper food, epidemic diseases, and other unhealthy conditions.

As a matter of fact, no military ambulance service has, so far, been able unassisted to grapple satisfactorily with the huge masses of sick and wounded incidental to a great campaign. Solferino, with its five leagues of battle-ground thickly strewn with wounded troops in every stage of agony and lingering despair, incited the different nations to establish Red Cross Societies. Yet in the Franco-German War, when these "societies put forth all their strength and struggled with unexampled energy," the wounded re-

mained at Sulz "for three days absolutely deserted on the battle-field, and exposed to cold and hunger," and at Gravelotte, where the ambulances "could not arrive in time, their absence was severely felt."\* At the beginning of the Russo-Turkish War, the Russian official medical service "compelled the admiration of connoisseurs, who said, that nothing was left for others to do"; yet during the progress of the campaign, the efforts of the official medical service, the exertions of the Red Cross Societies, and the benevolence of private individuals were all taxed and strained to the utmost in the endeavour to succour the prodigious masses of sick and wounded troops.

As to our own Army Medical Service, we are told by one of the Medical Staff that both in officers and men, it is "quite too small to deal with a large foreign war;" that, "we are to-day passing through the constructive stage of the organization of medical aid to armies in the field," and that "it will take a generation to carry out organization to its true stand-point of efficiency." Further, it is pointed out that the "Army Estimates" are "heavy," and "cannot very largely exceed their present amount:" and that the "paucity of men" and "costliness in maintaining them," consequent on our system of enlistment (as distinguished from conscription), render it quite impossible to support an Army Medical Service of sufficient numerical strength to relieve the wants of the sick and wounded during a great war. Moreover, the Volunteer Force, from which a great deal might reasonably be ex-

\* *The Red Cross*, Gustave Moynier, translated by John Furley.

pected, is powerless, in case of war abroad, to assist the Army Medical Service with trained and drilled ambulance men; for, strangely enough, though about 200,000 strong, it is itself lamentably deficient in anything like medical and ambulance organization. Hence the need of instructing the people generally in ambulance work; so that all may comprehend fully what ambulance aid means, and, in war-time, involves. Hence the necessity of impressing upon the public what is required in the way of organization and equipment, of *matériel* and *personnel*, of discipline, drill and training, high courage (both moral and physical), devotion to duty, and boundless energy and determination, in order to lessen the horrors of war, and effectually minister to the wants of those who fall sick and wounded while upholding the honour of the British flag in a foreign campaign. Hence the necessity, too, of establishing a Volunteer Medical Service, 10,000 strong, and officered by skilled Surgeons (entirely exclusive of, and not interfering with the duties and rights of the Regimental Surgeons): which may work with the Volunteer Force, should the occasion occur, in the field; and also act as a reserve, from which, in case of need, a numerous and trained *personnel* may be drawn, for the Medical Service of the Regular Army: and, in furtherance of this scheme, "the Volunteer Forces need one Bearer Company and one Field Hospital for each Regimental District" these bodies "to be made up of Volunteer Medical Staff Corps Officers and Men, in addition to all existing regimental aid."

Passing from military to *civil* life, we find, though the conditions are very different, the same need for general ambulance instruction. The horrors and losses incidental to a war of any dimensions are of such appalling magnitude as to rivet the attention of civilized nations, and to evoke gigantic efforts for their alleviation. But fighting, however severe, has a limit. Military campaigns, though terrible enough, in all truth, from a humanitarian aspect, are nevertheless but temporary evils. It is far otherwise with, what I may call, the dark side—the untoward incidents—of *civil* occupations. Occasionally, it is true, the whole country is startled by some unexpected catastrophe, as the collapse of a railway bridge, an explosion in the recesses of a mine, or the wreck of an ocean steamer, by which scores, it may be hundreds, of people are swept into eternity, crippled for life, or seriously wounded: but sad and grievous as such great calamities always are, they are luckily exceptional occurrences, and are far overshadowed in reality by the perpetual dribbling away of the life and strength of the nation, bit by bit, little by little, by day and night, in the depths of the mine, amid the whirl of machinery, in the streets of crowded cities, on the hunting field, in country lanes, on rivers and water-courses—here, there, everywhere—by individual accidents, which, though scarcely noticed in the excitement and bustle of every-day work, mount up into terribly large items of the annual bill of suffering and death—such as 1,230 killed and 8,123 injured on railways; 1,000 killed and 100,000 wounded in collieries and

mines ; 3,000 drowned in rivers, lakes, and other inland waters ; 8,501 injured in factories, and so on. Surgeon-General Longmore's remarks concerning the wounded in war apply with equal force to those who are injured in the peaceable avocations of civil life : for the manner in which immediate assistance, or "first aid," is given, the promptitude with which it is rendered, and the fashion in which removal of the sufferers is carried out, in cases of accident, is truly a "serious concern," . . . "not merely important in respect to preventing aggravation of existing suffering," but on which "the question of life itself, in numerous instances," and, "in many others, the whole future state of the wounded, whether it shall be one of continued pain and of comparative uselessness, or the reverse of these conditions," depends. So, too, in sudden seizures of illness, as fainting, apoplexy, fits, and poisoning, the chances of a patient's recovery are increased or diminished according as the efforts of the bystanders for his relief are well-directed or injudicious : and in any case, whether of sickness or injury, in which the removal of the sufferer is necessary or desirable ; on the manner in which such removal is conducted depends, in many instances, the life ; in several others, the future welfare ; and in all, the comfort, of the patient.

R. LAWTON ROBERTS, M.D.

RUABON, NORTH WALES,

*August, 1886.*

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# AMBULANCE LECTURES.

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## LECTURE I.\*

The St. John Ambulance Association—Its origin, objects, and progress—Necessity of general instruction in Ambulance work—A general description of the structure and functions of the human body—The Triangular Bandage—First aid to the injured, general precautions—First dressing of wounds—First Field Dressings.

THE course of five Lectures which I commence this evening is given on behalf of the St. John Ambulance Association; and first of all, I must tell you a little about the Association itself—its origin, objects, progress and manner of working. The Association was established in the year 1877, and it was formed for the purpose of spreading sufficient instruction among people of all classes of society, to enable them to give *immediate* help in cases of injury or sudden seizures of illness.

In the presence of some great catastrophe, such as a terrible railway accident, a violent explosion, a large fire, or other misfortune that results in the maiming and wounding of our fellow-creatures, all are naturally eager to render help to the sufferers. Every one, indeed, is prompted by the ordinary feelings of humanity to give what assistance he can in such emergencies; but too often those who are present at the scene of an accident are unable to bestow any help on account of pure ignorance—they do not know *how* to give aid. Others again there are who, more confident in their own powers but equally uninformed, try boldly to render assistance, and consequently, from their want of skill and careless or rough handling, cause increased suffering to those injured, and may even jeopardise their lives. Now the object of the St. John Ambulance Association is to do away with

\* In these Lectures I have as far as possible avoided the use of hard and puzzling terms, as being unsuitable for my purpose, as well as confusing and unintelligible to my listeners; but I have in connection with Fig. 1, 4, 5 and 6, given, *simply for the sake of reference*, the technical names of some of the more important structures of the body.

this lamentable and often fatal ignorance, and to show all who will accept of their teaching how they may best render help to those injured, or taken suddenly ill, *until medical assistance arrives*.

The aims of the Association appeal so powerfully to our best feelings, and are, from whatever aspect we regard them, of such supreme and vital importance, that the enthusiasm with which they have been supported by the people of this nation, and the eagerness with which they have been imitated by the inhabitants of foreign countries, since the establishment of the Association in 1877, can scarcely be wondered at. During the few years the Association has existed, as many as 90,000 people have received its certificates of successful instruction; and the movement has extended to Gibraltar, Malta, Australia, New Zealand, Canada, China, South Africa, and the East and West Indies. The great German surgeon—Esmarch—was so impressed, when staying in this country, by the good work done by the ambulance classes of the Association, that on his return to Germany he instituted similar classes under the title of Samaritan Schools. In the same way the system of our Association is imitated in Russia. Dr. Karl Reyher, of St. Petersburg, delivers courses of five ambulance lectures to classes of from twenty to twenty-five men, and has had the *Aide-Mémoire* and the *Handbook* (written by Surgeon-Major Shepherd) of our Association translated into the Russian language for purposes of instruction.\* In the United States, too, ambulance work has been commenced on the same plan as that adopted in this country.

Bear in mind that the Association is not represented by any one class of society, neither is it the offspring of any one political party, nor the work of any one religious denomination or sect. People of all ranks, from members of the Royal Family† down to the most humble workmen, are among its pupils. Men holding the most different political opinions are all alike among its supporters; and churchmen, nonconformists—persons indeed of every religious denomination—alike approve of its work and encourage its progress. The Association also enjoys the highest approval and the most cordial co-operation of the entire medical profession: for

\* “The Red Cross Society and Ambulance Work in Russia,” Captain Dalton, *Brit. Med. Jour.*, Dec. 2nd, 1882.

† The Princess Christian holds both the Preliminary and Nursing Certificates, having passed the required examinations.

when engaged in ambulance work you are rendering immediate help before it is possible for a medical man to arrive; you are not "doctoring" at all, but merely giving such assistance (often of the highest value) as is possible by due attention to the common sense rules taught you by the Association. "When I look back on my career as a surgeon," writes Professor Esmarch,\* "I can with truth say that many and many are the times I have deplored that so very few people know how to render first aid to those who have suddenly met with some injury. This specially applies to the field of battle: of the thousands who have flocked thither in their desire to help, so few have understood how to render aid. But my remark equally applies to the circumstances of daily life. How many there are every year who die a miserable death, and who might have been saved by prompt aid, had any one been near who knew how to give it. It is a terrible position to stand beside some accident, to see the red blood pouring unceasingly from the wound, to see death every moment approaching nearer and nearer, and not know how to avert the evil. The desire to help a fellow-creature when injured exists in most of us, but people shrink from giving aid because they do not know how to do so, and are afraid of doing more harm than good." These words represent the general experience of the whole medical profession. Esmarch refers to cases where you may save life by stopping bleeding; but there are many other ways in which an ambulance pupil can give valuable help. Thus, if a limb is broken, you may, by the proper use of temporary bandages and splints, fix and steady the injured arm or leg so as to prevent the broken ends of the bone from piercing the flesh and skin during the removal of the patient; and by so doing you certainly lessen his pain and shorten the duration of his illness, and in many cases you are even the means of saving either his limb or his life. Again, when a person is pulled out of the water apparently dead from drowning, you may, by vigorous and persevering efforts to restore natural breathing, not unfrequently have the satisfaction of bringing about his complete recovery. You may also give valuable and immediate help in cases of burns, scalds, the bites of mad or venomous animals, and in sudden and unexpected seizures of illness, such as fits, fainting, and "strokes"; you may act promptly and efficiently in acci-

\* *First Aid to the Injured*, Esmarch. Translated from the German by H.R.H. Princess Christian.

dental or suicidal poisoning, in cases of suffocation from poisonous gases; and last but not least, you may be enabled, after receiving proper instruction, to convey the sick and injured to their homes or the nearest hospital without increasing their pains or aggravating their injuries.

I have told you what medical men think about the Ambulance Association: but you have only to consider the events of everyday life, and the risks attending the various occupations by which men earn their daily bread, in order to understand for yourselves the necessity that exists for every one to be able to give aid in cases of serious injury or sudden and alarming illness. In military campaigns enormous numbers of sick and wounded troops are constantly demanding immediate attention and proper conveyance from the scene of action to places where they will be subjected to skilled treatment; and it is perfectly impossible for the medical men present to give succour to all requiring it, when there are perhaps several thousands requiring their services at the same instant. Turning to civil life, it is stated that in the year 1883 no less than 1230 persons were killed and 8123 injured by accidents on the different railways of the United Kingdom; that "during ten years the fatal accidents in London streets from vehicles amounted to 2195, while the injuries were 28,071"; that "in collieries and mines the annual loss of life is at least 1000"; that "no less than 100,000 accidents, large and small, occur in the mines in this country in one year"; that about 3000 people are drowned annually in our rivers, lakes, canals, and other inland waters alone—not counting similar losses at the seaside and the mouths of rivers;\* and "that in the twelve months ending October, 1884, in factories alone 8,501 various bodily injuries, not fatal, were caused by machinery."†

But I need not dwell longer on statistics. You have only to consider your own experiences. There are some among you who work in coal-pits, and others in brickworks, iron-works and chemical works; and you know how, in spite of the utmost care, accidents will every now and then occur. One man gets burnt, it may be by hot metal, an explosion of gas, or some powerful chemical agent, as oil of vitriol or carbolic acid; another gets scalded by hot water or steam;

\* Reference No. 50, St. John Ambulance Association, July, 1885.

† *Annual Report, St. John Ambulance Association, 1885.*

another falls suffocated by some poisonous gas; and another gets badly hurt, a large blood-vessel being opened, perhaps, or a bone fractured. You know also that it is impossible always to obtain *at once* skilled assistance in cases of emergency. A medical man in active practice is a very busy and hard-worked individual, and he can seldom be got hold of at a minute's notice. I say that you are, from your own experience, perfectly aware of all this, and therefore you are in a position to appreciate fully the desirability of becoming acquainted with the readiest methods of giving *immediate* help to a suffering comrade until the arrival of your doctor; and also of carrying him, if necessary, to his home or the nearest hospital in such a way that his suffering will not be rendered more acute nor his injury aggravated by the process of removal.

The course of instruction required to enable you to help a suffering comrade in the moment of his distress and peril, is not in the least difficult to understand, neither will it take me long to impart it to you. Only five lectures, of which this is the first, delivered at intervals of a week, are needed to convey to you all the necessary information. But these lectures (though each should last an hour or an hour and a half, and be followed by half an hour's actual work in bandaging, putting on of splints, and similar exercises) will prove of little use unless you all meet frequently together for the purposes of practice. "Practice makes perfect" is an old motto which you will find holds good in respect of your voluntary task of acquiring knowledge of the methods by which you may render "first aid." When the lectures are completed, your progress and competency will be tested by an Examiner sent down by the Ambulance Association; and those of you who succeed in the examination will receive "certificates of proficiency." Successful candidates, however, should on no account cease their "practices" in the application of bandaging, tourniquets, splints, and in the different stretcher exercises; but should at least meet monthly for the purpose. Unsuccessful candidates, moreover, should not be crestfallen or disheartened; for they must have gained, during their course of instruction and their meetings for practical work, some amount of knowledge which may bear good fruit at a future period. After an interval of not less than a year, those who hold "certificates" will, according to the rules of the Association, be re-

examined; and after yet another twelve months have elapsed they will be examined for the third and last time, when each successful candidate will be entitled to receive a Bronze Medallion with his name and registered number engraved on the back. I trust, however, that you will not look upon Certificates and Medallions—honourable distinctions though they be—as the chief objects of your work; but rather that you will pursue your Ambulance studies in the hope that, when an emergency arises, you may be able—instead of standing aghast and palsied—to relieve the sufferings, perhaps save the lives, of your stricken comrades; that you may act a worthy part, together with your neighbours, in assuaging “that ever-constant, never-ending pain endured by the mass of civilians daily injured in railway accidents, in the streets, in the mines, and in all our varied industrial developments;”<sup>\*</sup> and that you may be competent (should opportunity occur; and you never know under what circumstances you may be placed) to succour the wounded during a military campaign and assist in their conveyance from the battle-field to positions of quietude and safety.

Another point which I desire earnestly to impress upon you is this,—that with whatever zeal you may pursue your self-imposed task; with whatever promptitude, devotion, and success you may act on the occasion of accidents—however terrible; still in point of numbers you will continue hopelessly and fatally deficient, until it is fully recognised and understood by the owners, managers, and men of all collieries, mines, manufactories, railways, and other fields of industry, in fact until it is acknowledged by the public—by the nation at large—that ambulance instruction should be *universal*. For example, here *you* are—thirty ambulance men—thirty men only out of a thousand or more employed by the same company, and distributed throughout an area—both above and below ground—which is measured by miles. Everything is going on briskly, all appears safe, when there comes quite unexpectedly a fall, a crash, a cry for help, and a shout for the “ambulance men”—and not one of you within a mile of the place! There is a poor fellow down with a large bloodvessel laid open and bleeding profusely. You hurry, one of you, to the scene of the accident, but it takes you, being a mile or more distant, several minutes to

<sup>\*</sup> *Ambulance Organization*, Surgeon-Major Evatt.



reach the spot. When you *do* get there, there is a pool of blood and a corpse. There is a man in the prime of life, the bread-winner of a large family; or, may be, a young man, the only son—the only support—of his mother, and she a widow, *lost*—lost for want of help—lost because the man nearest to him did not know how to use his fingers—lost because his “butty” was not an “ambulance man.” I might give many similar illustrations, but fortunately not always attended by such terrible results. And “these cases” writes Surgeon-Major Hutton, “are often occurring in this country.”

If we turn from railways, factories, and all other centres of labour and industry, to the various public bodies, as the police, the fire brigades, the navy and the merchant service, the army, etc., the necessity of *universal* instruction in the methods of giving “first aid,” and in the proper means of conveying the sick and injured from place to place, at once forces itself to the front. Are not the police continually brought face to face with accidents and injuries of all kinds? Have they not constantly, in their ordinary routine of duty, to deal with persons found insensible; to judge whether such unfortunates are “drunk or dying,” in a fit, faint, senseless from poisoning or injury; and to remove them carefully on stretchers to a place of safety, where skilled assistance may be obtained? And so with the members of other public bodies—firemen, soldiers, sailors, and others—of whom, as of the men of the police force, we are all so proud, and whose lives and health are of such vital importance to the nation. These men, as you know full well, are all exposed, in their respective callings, to great and peculiar risks, and too frequently meet with wounds, maiming, and violent deaths of varied and terrible kinds. Let us consider more especially the military force of this country, which—on account of its great reputation as a fighting machine—you would naturally expect, above everything else, to be complete as regards its ambulance staff of bearers and helpers, material, equipment, and organization. “To-day,” writes Surgeon-Major Evatt, “it would be absurd to say that our own, or indeed any foreign army, is yet completely organised in an ambulance sense.” And again “the ambulance service of the military force of this country must be looked upon as completely in a stage of development.” You may readily believe that it is impossible in times of peace to keep up the

extensive ambulance arrangements which are essential during a great war; and it is therefore very necessary that there should always be a large reserve of trained men and ambulance materials which may be drawn upon when the hour of trial arrives. You might reasonably expect such a reserve would be afforded, at all events in part, by the auxiliary forces: yet it was stated, as recently as May, 1884, that "our large militia force" is "completely defective in ambulance and medical arrangements," and that "our large volunteer army, 200,000 strong, is completely unprovided with bearer companies or field hospitals, and has nothing but some regimental help. There are probably not half a dozen ambulance waggons with the whole volunteer force."\*

Thus, to whatever class of people you turn—whether civil or military—you find the same pressing need of *universal ambulance instruction*—instruction as to the simple methods of rendering *first aid* in cases of sudden illness or injury; whether occurring on the battle-field or amidst the varied peaceable employments of civilian life—instruction as to the best means of *transporting* or *carrying* the sick and injured (it may be for a few yards or for many hundreds of miles); whether soldiers, from the front of an army to the "dressing stations" and "field hospitals" in the rear and thence home to old England; or civilians, from the scenes of their misfortune to their own homes, the nearest surgery, or to a neighbouring hospital. An excellent beginning has certainly been made: H.R.H. the Duke of Cambridge alluded especially, in an address at the Royal Military College, Sandhurst, "to the necessity for and the value of ambulance training to all branches of the naval and military services," and the remarks of the Field-Marshal Commanding-in-Chief on this subject "have since been further emphasized by the recent War Office order, authorizing the formation of Ambulance classes for both the regular and auxiliary forces in all garrison towns:"† and, as a matter of fact, innumerable ambulance classes, such as I am addressing this evening, have been formed throughout the length and breadth of the land, in connection with collieries, manufactories, fire brigades, volunteer corps, the police, military colleges, public schools, and other portions of the community. A good be-

\* *Ambulance Organization, Equipment, and Transport*, Surgeon-Major Evatt.

† *Annual Report, St. John Ambulance Association*, 1885.

ginning indeed has been made, but *only* a beginning. You have made a good beginning, for you have formed the first class in connection with these extensive works; but still you are only beginning, for however zealous, prompt, and proficient you may become, the good you can do is necessarily limited. You are too few. As I have shown, ambulance instruction should be universal; and all in these large works, above ground or below, should be ambulance men. To that end, I would earnestly impress upon you all—not only the gentlemen who have the control and the management of the works, but also the overlookers and the workmen themselves—the necessity of holding *regular annual ambulance classes*, so that every one connected with these extensive works may be by degrees properly instructed in “first aid,” and be fitted to act with promptitude and effect in an emergency. For similar reasons, it is highly desirable that *annual* classes of this kind should be held regularly in connection with all mines, factories, iron-works, warehouses, fire brigades, the police, the different volunteer corps, regular battalions, regiments, and batteries, colleges, public schools, in fact, all the different bodies of which the nation is composed. It may be long—perhaps many years—before these quietly-conducted, unostentatious, interesting, *annual* classes bear their natural and certain fruit; but when once the desired results are obtained, when once ambulance instruction becomes universally diffused throughout the nation, the People will take care that, even in the most stupendous wars, our soldiers shall, as far as trained helpers and costly equipment can effect it, be promptly aided in their moments of suffering and danger, and be rapidly withdrawn out of the battle to suitably placed “dressing stations” and comfortable though temporary hospitals in rear of the army, and thence—if unable to return to their duties—transferred in “hospital ships” back to their families and homes: the People will see that in all our great cities and towns, in all our country districts and villages, in connection with all our railways, mines, factories, and other industrial centres, attached to all our large hospitals and kindred institutions, there is permanently established a complete system of ambulance transport (of stretchers, wheeled stretchers or litters, horse ambulance carriages or waggons, ambulance railway carriages, ambulance steam-boats and launches), by which any person, hurt or taken suddenly ill, after being temporarily “aided” by

the first passer by or by his working comrade, may be rapidly borne off with ease, comfort, and in the recumbent position, to his home, the nearest hospital, or a neighbouring surgery; and the People individually—learning how to lessen the pains of others, how to help each other in case of accidents and unexpected illness, how to lift and carry their stricken comrades without disturbing the broken limb or jarring the bruised body—will go forth to their daily occupations, however toilsome or dangerous, with greater confidence, will show themselves more manly, braver, more humane, more charitable and neighbourly, and altogether prove themselves better and more useful citizens. Truly, as Surgeon-Major Evatt says, “*Let us as the years go on teach the people, and all will be well.*”

You have received from the Ambulance Association a number of triangular bandages, wooden splints, one or two elastic bands called tourniquets, and a very convenient stretcher. These articles will prove of the greatest possible service for purposes of instruction during the lectures, for practice when you meet together to go over what you have heard in the lectures, and also for use in any actual cases of emergency; but still you must not get in the way of depending solely upon them. One never knows when an accident is about to take place; and it will probably happen that when you want to give aid to an injured comrade you will have neither triangular bandages, splints, tourniquets, nor stretcher at hand for use. So you must always be prepared, if necessary, to improvise these articles—to use, for example, scarfs, handkerchiefs, or straps of any kind, for bandages; folded newspapers, cardboard, rolls of straw, sticks, or pieces of wood, for splints; a shutter, a door, a flour sack with two poles fastened to it, one on each side, for a stretcher; in fact, you must always be on the alert, in an emergency, to utilise any materials that are at hand and suitable, including your own garments as well as those of the patient, for the purpose of making temporary bandages, splints, or whatever other form of appliance you may require. You will be unable, however, to use these different articles, such as bandages, tourniquets, etc., with any good effect, and, indeed, you will altogether fail to understand the methods of giving first aid, unless you are acquainted in a general way with the formation of the body. I will therefore now endeavour to give you a very brief description of the structure and functions of the human body.

The Human body may be looked upon as a complicated and beautifully constructed piece of machinery. Like other machines, it has its props and supports, its joints, its levers, its pipes and conduits, and its valves. It is provided with a powerful pumping apparatus—the heart, and is supplied with a number of whitish strings or cords—the nerves, which pass from one part to another and act as telegraph wires. As other machines are supplied with fuel and water, so the human machine derives sustenance from food that is swallowed and wholesome air that is breathed; and as other machines get rid of their ashes, so the body throws off its waste materials by means of its organs of excretion.

### THE BONES (Fig. 1).

These form the props, supports, stays, and levers of the body. They vary much in shape and size, according to the particular purpose for which each is adapted, and are fastened or *jointed* together so as to make one powerful framework—the *skeleton*, about which the remaining and softer parts of the body are arranged and securely fixed. The skeleton or bony framework of the body therefore serves to support or carry the flesh, arteries, nerves, and other soft tissues; and in addition, the different bones serve various purposes, according to their situation. Thus, some are firmly united together in such a way as to enclose and protect from external violence certain delicate and all-important organs; for example, the bones of the skull form a strong case in which the brain is securely placed; the bones of the pelvis join to make a powerful and deep ring of bone which surrounds and shelters the bladder and other vital parts; the numerous bones composing the spine are so arranged one above the other as to lodge and give protection to the spinal cord; and the breast-bone, ribs, and a portion of the spine are connected together in such a beautiful manner that they encircle and guard the lungs and heart at the same time that the movements of breathing are regularly continued.

Other bones, again, act as pillars of support: for instance, the various bony fragments or *vertebræ* of which the spine is built up go to form the chief pillar of support of the body; the thigh bones and the bones of the legs also serve as powerful pillars of support, which sustain the weight of the

body in the erect position.

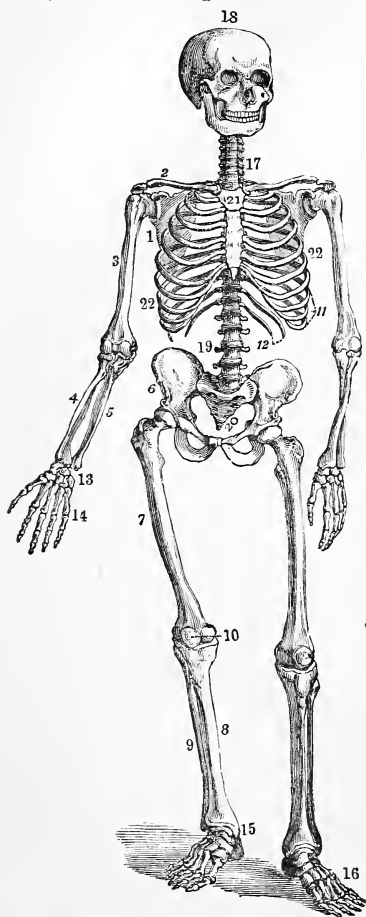


FIG. 1.—The Skeleton.

Some bones also serve as levers, such as the long bones of the upper and lower limbs, by means of which (when the muscles act on them) the position of the body is altered, weights are lifted, or other movements executed. Just as the bones vary in shape and size according to the work they have to perform, so the way in which they are fastened, coupled, or *jointed* together differs in different parts of the body. Thus, the bones of the skull are securely and rigidly fastened together, so as not to admit of any movement, and the *joints* between them (or their points of union) are *fixed*. On the other hand, the bones of the limbs are united together by *movable joints*, as it is necessary for the use of the arm and leg that the bones should move freely one on the other at the points where they are coupled together. The construction of one of these movable joints is well worthy of your attention: the ends of the bones are covered with a layer of gristle, so that they move smoothly one on the other, and are bound

Head, 18; spine or back-bone, 17, 19; chest, 22, 22; sternum or breast-bone, 21; pelvis or haunch, 6; sacrum or rump-bone, 20; scapula or blade-bone, 1; clavicle or collar-bone, 2; humerus or arm-bone, 3; radius or outer fore-arm bone, 4; ulna or inner fore-arm bone, 5; carpus or wrist, 13; metacarpus or hand proper, 14; femur or thigh-bone, 7; patella or kneecap, 10; tibia or shin-bone, 8; fibula or splint-bone, 9; tarsus or heel and instep, 15; metatarsus or foot proper, 16.

securely together and enclosed by a strong fibrous bag or capsule, which is lined by a delicate membrane that pours forth an oily liquid into the joint, causing it to work smoothly and easily.

### THE HEAD (Fig. 1—18).

The head is formed of twenty-two bones, which are all (with the exception of the lower jaw) closely united and immovably locked together by fixed joints. By far the greater portion of the head—all the rounded upper and hinder part—consists of a strong hard case, which encloses, supports, and protects the brain. The brain is not only a very important organ, but is also an exceedingly tender and delicately-constructed one; and it derives additional security from the arched form of the case containing it, as well as from the beautiful manner in which the eight bones forming the case are securely dovetailed, so to speak, together at their edges. The remaining fourteen bones unite at the fore and under part of the head to form the sockets of the eyes, the cavities of the nose, the cheeks, and the mouth; in fact, taken together, they constitute the *face*. All the bones of the face and the brain case are very firmly and fixedly jointed together, with the exception of the lower jaw, which is movable for the purpose of eating. Both upper and lower jaws are also provided with exceedingly hard, durable, and useful little chisels and wedges, in the form of *teeth*, for the purpose of cutting, breaking down, and grinding our food. Four of the organs of the senses are also situated in the head, and are to a certain extent afforded protection from external violence by the arrangement of the bones: thus, the tongue, or organ of taste, lies in a position of safety in the mouth between the jaws; the eyes, or organs of sight, recline snugly in their bony sockets; the nose, or organ of smell, is lodged securely between certain bones of the face; and the ears, or organs of hearing, are deeply buried in bone, one on each side of the head.

### THE SPINE (Fig. 1—17, 19).

The spine, or back-bone, does not consist of only one piece, but is composed of twenty-four bony fragments—segments—or, as they are called, *vertebræ*, placed one above the

other. These vertebræ are, however, not placed next to each other, but have interposed between them firm but elastic indiarubber-like pads of gristly substance. It is to this peculiar construction that the spine owes its remarkable elasticity and flexibility—qualities which allow of turning and bending movements of the body, and at the same time prevent undue shock or jarring from the acts of jumping or falling. The spine is the principal and central pillar of support of the body, sustaining the weight of the head, chest, and upper limbs, and gradually increases in size, in due proportion to the load it has to bear, towards its lower end. I have already told you how securely the tender brain is encased in the head, but it is none the less necessary that such a delicate and important organ should be preserved from any shock during movements of the body. The peculiar construction of the spine does away with this risk, for the head rests upon the summit of the back-bone very much as a carriage rests upon its springs. The spine also lodges, encloses, and protects the spinal cord (or spinal marrow), which is a continuation of the brain.

### THE CHEST (Fig. 1—22, 22).

This is a spacious cavity, formed by the junction of the ribs, breast-bone, and spine, which contains and protects the heart, the two lungs, and certain important blood-vessels, nerves, etc. The ribs, twelve in number on each side, are united behind by movable joints to the back-bone, while in front they are connected with the breast-bone by means of firm but pliable gristle.\* By this admirable arrangement the chest, besides encircling and protecting the vital parts already mentioned, is exceedingly springy and elastic, and so can better withstand severe squeezes, blows, or shocks; and at the same time it admits of the movements of breathing—that is, the regular rising and falling of the fore part and sides of the chest corresponding with an alternate increase and diminution of its cavity, as air is drawn into and

\* The seven upper ribs on each side are joined by pieces of gristle (or *cartilage*) directly to the breast-bone, and are called *true* ribs. The remaining five are termed *false* ribs (Fig. 1—11, 12); of these, each of the upper three is united by gristle to the rib immediately above it (Fig. 1—11); but the two lowest are altogether unattached in front, and are therefore named *free* or *floating* ribs (Fig. 1—12).



driven out of the lungs. I shall have to refer to this later on in connection with breathing, so I need only add that the chest is bounded below and separated from the belly by a fleshy or muscular partition—the *midriff*.

### THE PELVIS (Fig. 1—6).

This is a very strong, irregular-shaped, and deep ring of bone, which encloses a large basin-shaped cavity. It is formed at the sides and fore part of two large haunch-bones, which are united firmly together in front and immovably jointed behind to the triangular-shaped rump-bone. The last-named bone supports the spine by its broad upper end, and has attached to its narrow lower end the small and comparatively unimportant tail-bone. The pelvis, therefore, consists of four bones immovably fixed together so as to form a very powerful, deep, and somewhat irregular bony ring, which contains and protects the bladder and various other vital parts; sustains the weight of the chief pillar of support of the body—the spine; supports the intestines, and indeed the whole trunk; and connects the body with, and transfers the burden of it to, the lower limbs through the medium of the two powerful but freely movable hip joints.

The portion of the trunk known familiarly as the *belly* consists of the large and roomy cavity which lies between the chest (from which it is separated by the *midriff*) and the pelvis, and it contains the stomach and intestines, the liver, the pancreas (or sweetbread), the kidneys, the spleen, and many very large blood-vessels and important nerves.

### THE UPPER LIMBS (Fig. 1—1, 2, 3, 4, 5, 13, 14).

These are capable of very great freedom and variety of movement on account of the manner in which the bones of the shoulder are shaped and arranged.

The *shoulder* consists of the blade-bone and the collar-bone. The blade-bone is of a triangular shape, rather light, and is placed so as to lie movably on the upper and hinder part of the chest. The collar-bone marks the line of division between the neck and chest in front, and is united to the upper part of the breast-bone by its inner end, and to the blade-bone by its outer end; it serves the purpose of sup-

porting the shoulder, and also of keeping it at its proper distance away from the chest. When a collar-bone is broken the shoulder of the same side sinks downwards and inwards towards the chest.

The *arm*, or the portion of the upper limb between the shoulder and the elbow, is possessed of one bone. This is connected at its upper end with the blade-bone by a very movable joint of the character of a "ball and socket." The "ball" of the joint—the upper end of the arm-bone—is large and rounded, while the "socket" of the blade-bone is comparatively small and shallow; and this arrangement of the joint, together with the movable position of the blade-bone, accounts for the extraordinary freedom and variety of movement possessed by the upper limb. In the *fore-arm*, or the part of the upper limb extending from the elbow to the hand, there are two bones—an inner and an outer one—of about the same size. At the elbow these bones are connected with the lower end of the arm-bone by a movable joint, which possesses all the characteristics of a true "hinge." The chief peculiarity of this portion of the upper limb is the arrangement between its bones, by which the outer one (that on the *thumb* side) is capable of rolling around the inner one, thereby enabling the forearm to be twisted at will, so that sometimes the palm and at other times the back of the hand may be uppermost.

The *hand* is united to the fore-arm by a movable joint between the wrist and the lower large end of the outer bone of the fore-arm. The *hand* includes the wrist, consisting of eight small bones placed in two rows; the hand proper, made up of five bones which constitute the palm and the ball of the thumb, and which support the fingers; and the fingers, comprising fourteen bones, three in each finger and two in the thumb.

#### THE LOWER LIMBS (Fig. 1—7, 8, 9, 10, 15, 16).

In the upper limbs, which serve the purpose of lifting, seizing, or carrying objects, of using the hands in fact in any way desirable, the bones are, comparatively speaking, lightly formed, and are so arranged as to allow of great and varied movement. In the lower limbs, on the contrary, by means of which we stand, walk, and run, and which serve

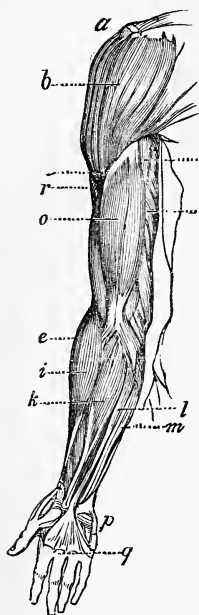
as pillars of support to the entire weight of the body; the bones, though arranged much on the same plan as those of the arms, are much stronger, more massive, and are connected together by joints of much greater strength in such a way as to render the lower limbs exceedingly powerful, but less capable of extensive and varied movements.

The *thigh*, like the upper arm, possesses one bone; but this is the longest and most powerful in the body, and is connected with the pelvis by a movable "ball and socket" joint of immense strength. The lower end of the thigh bone is united to the upper end of the large bone of the leg by the large and complicated knee-joint, at the front of which (forming the prominence of the knee) lies a small oval bone called the knee-cap. By the term *leg* I mean that portion of the lower limb which extends from the knee to the ankle. There are in the leg, as in the fore-arm, two bones: one is much larger than the other, occupies the inner and fore part of the leg, enters by its upper end into the knee-joint and goes by the name of the shin-bone; the smaller bone, which lies on the outer side of the leg, is called the splint-bone. These two bones are firmly united together, forming a strong pillar of support, and are connected with the foot at the ankle by a powerful joint of the "hinge" type. The *foot* includes the heel and instep, which are made up of seven bones of various shapes and sizes; the foot proper, consisting of five bones; and the toes, containing fourteen bones, three in each toe and two in the great toe.

### THE MUSCULAR SYSTEM.

By the term *muscle* I mean flesh—lean red flesh: and the expression muscular system refers to all the flesh contained in the body. The flesh clothes the skeleton, forms a great proportion of the body, and gives shape to the limbs; but it is not scattered about, so to speak, without any plan. It is beautifully divided and arranged into separate masses or *muscles* (Fig. 2), each of which during life has its proper work to perform. Some of these masses of flesh, or muscles, are attached by their ends to different bones, as in the limbs; and when they contract (that is to say, when at our wish they *shorten* and thicken) one or other of the bones to which they are attached is moved; if one of the bones is fixed, the other bone is

drawn towards it. Thus it is that when we wish to walk, run, jump, carry a weight, or perform any other act, a number of muscles are instantly thrown into contraction, the levers



or bones to which they are attached move, and the particular movement we desire is at once gone through. In some parts of the body the muscles are placed at a distance from the bones on which they act: thus, for example, the muscles which bend and straighten the fingers are situated in the upper portion of the fore-arm (Fig. 2). In such cases as these each muscle terminates in a long fibrous cord, sinew, leader, or *tendon*, which is attached to the distant bone on which the muscle acts. In movements of the hand and fingers you can, particularly in a thin person, perceive these tendons working at the back of the hand and the front of the wrist. In other parts of the body the muscles are very delicate, and are attached to the skin, and communicate with each other, as well as being connected with the bones. So it is in the face, all the varied expressions of which are due to the contractions of the different muscles in that situation. Now, all these muscles that I have been speaking of act when we

#### g. 2.—Muscles of Arm.

This figure represents the different masses or muscles, *a, b, c, d*, etc., into which the flesh of the arm is divided; and it also shows well the leaders or *tendons*, alluded to in the accompanying letterpress.

*wish* them to do so. If we *wish* to walk, run, put on a certain expression of face, raise a biscuit to our lips, and so on, certain groups of muscles contract at once and bring about the desired movement in obedience to our *wish* and *will*. Such muscles are described as *voluntary muscles*, or muscles that act in obedience to the will. Other muscles there are, however, that are termed *involuntary*, because they act quite independently of our wish or will. These are not attached to the bony levers of the body, but are connected with important vital internal organs, the working of which if dependent on our will would be speedily deranged. The heart is a powerful muscle of this

description: it goes on working as long as life lasts, day after day, night after night, no matter in what state we are—sleeping, or wide awake, insensible, delirious, or in convulsions. Where should we be if the action of the heart depended on our will? Again, in the coats of the stomach and intestines there are delicate involuntary muscles by which those organs contract on to the food, churn it up, and drive it onwards. What a mess we should make of our digestion if the action of those organs depended on our will! In the coats of some of the blood-vessels also (the arteries) there are delicate involuntary muscles, which have an important effect on the circulation of the blood; if the action of these depended on our will, one of the most important parts of the mechanism of the body (the circulation) would be continually neglected and out of gear. I might give other examples, but I have afforded you sufficient illustrations to show that of the red lean flesh or muscle of the body, one portion acts in obedience to, and another independently of, the will: and that all movements of the body, or its internal organs, are due to the contraction of one kind of muscular tissue or the other.

## THE NERVOUS SYSTEM.

This refers to the structures you know by the names of the *brain*, *spinal cord* or *spinal marrow*, and the *nerves* (Fig. 3), and also includes something else you probably have never heard of, viz., the *sympathetic nervous system*.

The brain is, as I have already explained, supported, enclosed, and protected from external violence by the bones of the skull. It consists of two portions, one of which—the brain proper or the large brain—occupies by far the greater part of the cavity of the skull, and is much larger than the other—the little brain or small brain—which is situated in the hinder and lower part of the head. The large brain is the seat of the intelligence, the emotions, and the will: the small brain serves to regulate the movements of the body, maintaining the balance or equilibrium between the two sides during our different actions. The brain, together with its continuation—the spinal cord—which is enclosed and protected by the spine, forms the central portion of the nervous system, from which a number of white cords—

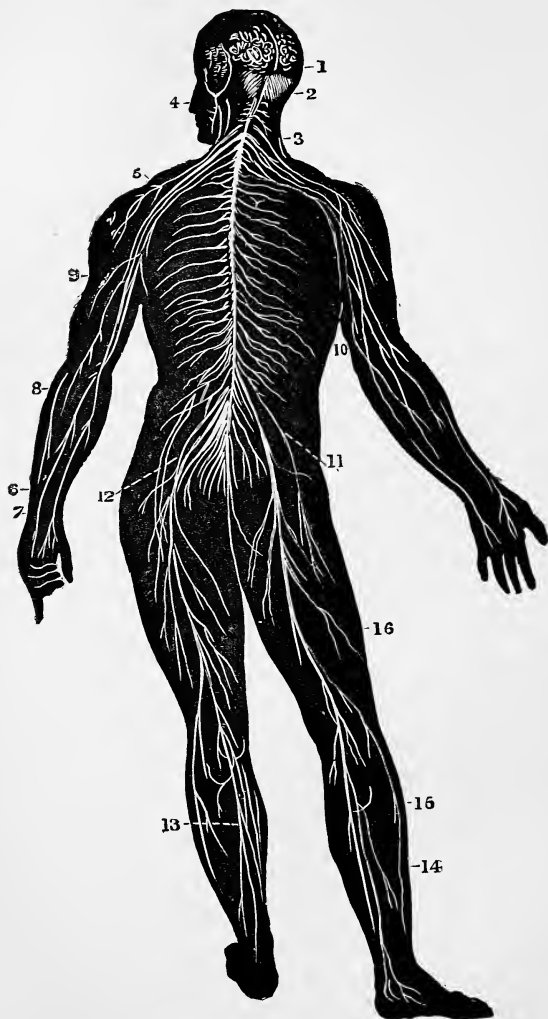


FIG. 3.—The Nervous System.

This figure shows the general arrangement of the nervous system—the brain proper or large brain, 1, and the small brain, 2, in the head; the spinal cord or spinal marrow—a continuation of the brain—along the back; and the nerves, 4, 5, 6, 7, 8, etc., coursing from either brain or spinal cord to all parts of the body.

the nerves—branch off (nine pairs from the brain, and thirty-one pairs from the spinal cord), and after dividing into smaller and smaller cords and threads finally terminate in the various voluntary muscles and the organs of the senses—ears, eyes, nose, tongue, and skin. Now the nerves serve much the same purpose as telegraph wires. When we wish to perform any movement, as biting, walking, running, or lifting, orders are flashed along them by the will from the brain to the different voluntary muscles that are required to act; if to the muscles of the head, along the nerves which course directly from the brain itself through apertures in the skull to their destination; if to the muscles of the trunk or the upper or lower limbs, down the spinal cord and along the nerves that proceed from it to the different parts of the body; and the muscles on receipt of the orders telegraphed to them immediately contract, act on the bones or levers to which they are attached, and the desired movement is at once executed. Nerves along which orders are thus transmitted from the brain to the voluntary muscles with the result of bringing about movements of the body are called *nerves of motion* or *motor nerves*. But messages are also sent along nerves in a contrary direction, viz., from the delicate extremities of the nerves to the brain: thus, for example, when we cut or scald one of our feet, a message is telegraphed up along a nerve to the spinal cord and along the cord up to the brain, and we feel pain; when we are examining some object with our hands the tender ends of the nerves in the skin receive certain impressions of touch that are in a similar way flashed up along nerves and spinal cord to the brain; when we look at a picture, listen to music, or taste a strawberry, the impressions received respectively by the ends of the nerves of the eyes, ears, and tongue are transmitted direct to the brain with the result that we see, hear, and taste. Nerves along which impressions or sensations are transmitted from their terminations to the brain are called *nerves of sensation* or *sensory nerves*. Nerves which are both motor and sensory are spoken of as *compound*.

You can now understand how it is that in those terrible cases of severe injury to the spine which you occasionally meet with, the patient loses all power and all feeling in his lower limbs; in such accidents the spinal cord itself is injured, the telegraphic communication between the brain and the ends of the nerves is cut, no order from the brain

can reach the lower limbs, so there is loss of power to contract the muscles, or paralysis, and no impressions can be conveyed from the legs to the brain, so there is complete loss of sensation. Similarly, when a motor nerve is cut by an accident, there is loss of power or paralysis of the voluntary muscles in which it terminates; when a sensory nerve is injured or diseased, there is loss of sensation in the part in which it ends; and when a compound nerve is severed, there is loss of both power to move, and also of sensation in the portion of the body to which it is supplied.

While describing to you the action of the brain, spinal cord, and nerves, you will doubtless have noticed that I spoke only of the *voluntary* muscles as acting in obedience to the mandates of the will transmitted to them along the nerves. The *involuntary* muscles, such as the heart, etc., act quite independently of the will, are quite uninfluenced by it, and are kept working regularly, and properly fulfilling their functions by another portion of the nervous system termed *sympathetic* or *ganglionic*. It is called ganglionic because it consists of a double row of small masses of nervous tissue or *ganglions* connected with each other by delicate branches or threads, and is situated along each side of the spine. From the little masses or ganglions, branches are distributed to the heart, to the muscular tissue of the stomach, intestines, arteries, bladder, and other important parts; and—whereas our sensations and the action of our voluntary muscles depend on the brain, spinal cord, and nerves—the proper working of the organs of circulation, respiration, digestion,—in fact the due maintenance of the vital functions of the body from the beginning of life until death—during periods alike of insensibility, sleep, and wakefulness, entirely depends on the sympathetic or ganglionic nervous system.

### THE BLOOD AND THE ORGANS OF THE CIRCULATION (Figs. 4, 5 and 6).

The length of time that an ordinary machine will last in working order depends on the durability of the materials of which it is constructed, and the power they have of resisting the effects of wear and tear; and, as you well know, machinery built up of very strong and hard substances, as steel,



iron, and oak, will, if properly looked after and cleaned, prove useful for a great number of years. It is very different, however, with the mechanism of the human body. The wear and tear caused by the due performance of the different vital

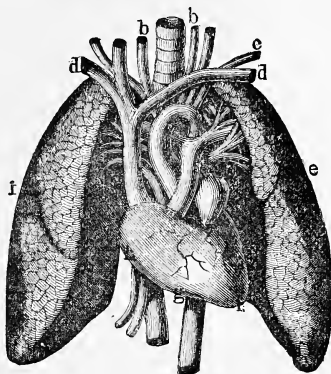


FIG. 4.—Heart, Lungs, and Large Blood-vessels.

The figure shows the heart, *h, g, i*, in its position between the two lungs, *f, e*. *d, d*, are the veins from the upper portion of the body, and the tubes below *h* are the veins from the lower part of the body, conveying dark impure blood to the right side of the heart. *b, b, c*, are branches from the large main artery, or aorta, which springs upwards from the left side of the heart in the form of an arch and curving backwards courses down behind the heart near *g*. Running upwards from the right side of the heart, and branching off to both lungs, is seen the pulmonary artery. Between *b* and *b* the windpipe is represented.

functions, and the waste resulting from the regular working of the various tissues and organs, is so excessive, especially in the nervous and muscular systems, that the human machinery would speedily stop—the span of life would indeed be short—were there not a beautiful provision by which all the structures of the body constantly received materials for their growth, sustenance, and repair. This arrangement, by which every tissue and every organ of the body is continually provided with suitable nourishment, and by which, moreover, at the same time, all the different structures regularly get rid of the products of waste, wear and tear, and decay—the ashes of the human machine—is the *circulation of the blood*.

All of you know the general appearance and character of

*blood*, its colour—either bright red or dark purple, and its property of clotting or coagulating—that is, of separating (after death, or when escaped from the body during life) into a clot and an almost colourless fluid. There is a considerable quantity of blood in the body—about 12 or 15 lbs. in a man of ordinary weight; and there need be, for remember that it serves as a carrier *to* all the different tissues and organs of materials for their growth and repair, and *from* all the various structures of products of their waste and decay. All this quantity of blood is not accumulated in any one tissue or organ, nor does it lie stationary or stagnant; but, on the contrary, it is diffused through all parts of the body, and is in perpetual movement, being regularly and continually driven through a complete system of tubes, called *blood-vessels*, by the pump action of the *heart*. The heart is a very powerful muscular organ, about the size of a man's fist, situated in the cavity of the chest between the lungs (Fig. 4). It would take much too long to describe to you fully the wonderful construction of the heart and its beautiful valves. It is sufficient for you to know that it is shaped like a hollow bag; that it is divided into two parts, a right side and a left side; that it works with a pumping action, contracting and dilating regularly about seventy or eighty times in a minute; and that the left side contains bright scarlet blood, full of nutriment derived from the food we swallow, and of oxygen gas derived from the air we breathe; and the right side dark purple or blackish blood, charged with carbonic acid gas and other products of decay and wear and tear of the different parts of the body. From the right side of the heart the dark impure blood is pumped into the lungs to be purified (Figs. 4 and 5); but from the left side the brilliant scarlet healthy blood is driven into a large tube which gives off numerous branches that course in different directions through the body, and in turn split up into smaller and smaller divisions until every tissue and organ is reached by them. These tubes, along which the bright red blood is driven by the pump action of the heart to every part of the body, are called *arteries* (Fig. 5, *a*, and Fig. 6); they are strong and elastic, and are for the most part placed deeply under cover of the flesh or in other positions of safety. In some parts of the body, however, notably at the wrist, upper arm, temples, and neck, the arteries run so near the surface that their beating, pulsation, or *pulse* (caused by the successive waves of blood

being driven along them by the pumping of the heart) can be easily felt, and in many instances seen. The arteries of different regions of the body are called by various names, such as Carotid, Brachial, Femoral, &c., for the sake of more

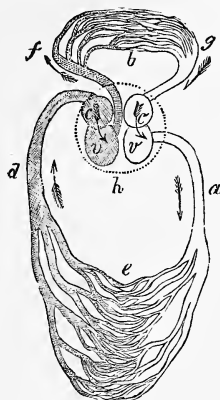


FIG. 5.—Plan of the Circulation.

*h.* Heart, divided into a right and left half, each consisting of an upper cavity, called an auricle, *c* and *c'*, and a lower cavity called a ventricle, *v* and *v'*. *a.* Arteries, conveying bright scarlet blood from left side of heart to all parts of body. *e.* Capillaries. *d.* Veins, carrying dark impure blood from all parts of body to right side of heart. *f.* Pulmonary artery conveying dark impure blood from right side of heart to lungs. *b.* Pulmonary capillaries. *g.* Pulmonary veins carrying bright scarlet blood from lungs to left side of heart. *a, e, d.* The greater or systemic circulation. *f, b, g.* The lesser or pulmonic circulation.

The arrows show the direction of the current of blood.

conveniently distinguishing one from the other ; but there is no reason why you should confuse yourselves by trying to remember a number of hard words, providing that you know the situation of the more important arteries, and I shall point out to you in the next lecture the position of most of the larger vessels. The arteries divide into smaller and smaller branches until they finally end in a gigantic network of extremely minute and delicate tubes—so small that they can only be seen with the microscope—which pervade all the different tissues and organs of the body. These tender tubes are called *capillaries* (Fig. 5, *e*) ; into them the bright red healthy blood pours from the arteries, and as it flows along them the blood gives up the oxygen and the nutriment which

it contains to the surrounding structures for their growth, repair, and functional requirements. But as it courses along

This figure is intended to give a general idea of the position of the chief arteries. The main artery, *i*, called the aorta, springs from the left side of the heart, and arching backwards courses down close to the spine as far as *f*, where it divides into two large branches. From this main arterial trunk branches are distributed to all parts of the body. Two large vessels, named the carotid arteries, *b*, *c*, run upwards, one on each side of the neck, and divide into branches which supply the brain and head; of these, the figure shows the temporal artery, *a*, running upwards in front of the ear; and the facial artery, near *b*, which winds over the lower jaw to the face. Each of the upper limbs is supplied by a large artery which passes under the collar-bone, over the first rib, down through the armpit and along the inner side of the arm to a little below the front of the elbow, where it divides into two branches—one of which runs down the outer part, the other down the inner part, of the fore-arm as far as the hand, where they unite to form two curves or arches in the palm, *d*, *e*, *g*, *h*; the artery is called subclavian, *d*, when near the collar-bone; axillary, when passing through the armpit, *e*; brachial, when between the armpit and elbow, *g*; and in the fore-arm the outer artery is called radial, *h*, the inner one the ulnar; and the curves formed by the two vessels in the hand are named palmar arches. Each of the lower limbs is supplied by a large artery which enters the thigh at the centre of the fold of

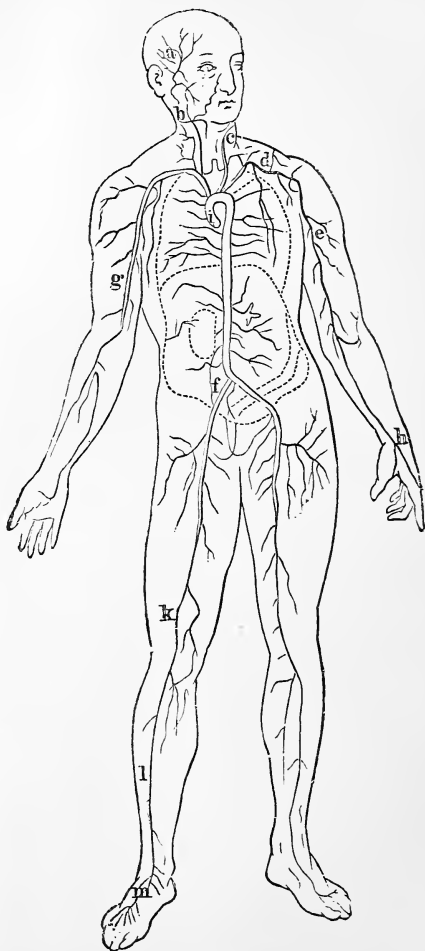


FIG. 6.—The Arteries.

the capillaries the blood does something more than supply nourishment to the neighbouring parts; it absorbs and takes up from the adjacent tissues the results of decay and of the wear and tear of work, such as carbonic acid and other useless and noxious matters that it is necessary for the system to get rid of. Following the plan of the circulation (Fig. 5) the capillaries join again together into larger tubes, and these unite again and again until at last they terminate in *veins* (Fig. 5, *d*). The blood enters the capillaries pure and bright scarlet in colour, but during its passage through them it gives up its oxygen and its nourishment, and becomes charged with carbonic acid and other hurtful materials, so that it flows from the capillaries into the veins a dark purple or blackish impure stream. The veins are the tubes along which the dark impure blood flows from all parts of the body to the heart—to the *right* side of the heart; they are thin-walled and flabby, and are provided with valves, so that the blood which flows along them in a sluggish *continuous* stream, cannot move backwards when acted on by gravitation, as in walking, standing, and other positions. Some veins are situated deeply, accompanying the arteries in their course; but many are quite superficial, and so close to the surface that they can be seen through the skin in some parts of the body as dark blue lines or cords, more especially in thin people. You may frequently notice them on the backs of the hands, and the front of the fore-arm and elbow, especially after manual exertion, or when the arms have been held down for some time; also on the tops of the feet, and the back and sides of the legs, particularly after much standing, or a long walk; you may often notice also little swellings like knots in the course of the dark blue lines, and these indicate the points where valves are placed. The different veins unite together to form larger veins, and terminate at last in two main trunks which pour the dark impure blood, collected from all parts of the body, into the right side of the heart. Now you may ask, How is this dark impure blood, charged with carbonic acid and other effete materials, purified and

the groin, and coursing downwards passes back, about the lower third of the thigh, into the ham; a little below the knee-joint it divides into two branches, one of which runs down the fore-part the other down the hinder-part, of the leg to the foot, *f, k, l, m*; the artery of the thigh is called the femoral artery; that of the ham the popliteal artery; that of the fore-part of the leg the anterior tibial artery; and that of the hinder-part of the leg the posterior tibial artery.

reddened ? It is pumped by the right side of the heart away along a tube (called the pulmonary artery, Fig. 5, *f*, the only artery in the body which contains dark blood) into the lungs, where it passes from the branches of the pulmonary artery into a net-work of those delicate little tubes called capillaries (Fig. 5, *b*). While flowing through these capillaries, which permeate the lungs in all directions, and indeed constitute a considerable portion of them, the blood *gives up its carbonic acid* (together with some watery vapour) *to the air* which is drawn into the lungs by the process of breathing ; and at the same time *takes up oxygen from the air* in the lungs, and so flows on, purified and bright scarlet once more, into the veins (called pulmonary veins, Fig. 5, *g*, the only veins in the body which contain bright red blood) along which it pours again into the *left* side of the heart.

Such, then, is the general plan of the circulation : bright red blood is pumped by the *left* side of the heart to all parts of the body, from which it is returned dark and impure to the *right* side of the heart ; the *right* side of the heart pumps the dark impure blood to the lungs, from which it is returned bright red and pure to the *left* side of the heart. The current of blood which passes from the left side of the heart through all the structures of the body to the right side of the heart is sometimes spoken of as the *greater* or *systemic circulation* (Fig. 5, *a*, *e*, *d*), whereas the flow of blood from the right side of the heart through the lungs to the left side of the heart is called the *lesser* or *pulmonic circulation* (Fig. 5, *f*, *b*, *g*).

If the heart or any of the blood-vessels fail, from injury or disease, in performing the work allotted to them, then results of a more or less serious character soon follow ; for instance, when the heart acts very feebly in consequence of over-exertion and fasting, an insufficient supply of healthy blood is pumped up to the brain and head, the patient turns deathly pale and falls insensible—in a word, he *faints* ; in another case a small blood-vessel gives way in the head, the blood accumulates, and by pressure on the brain causes loss of power or paralysis of one side of the body—in other words, the patient has a *stroke* ; again, a man meets with an accident by which the chief blood-vessels of one of his limbs are injured so seriously as to arrest the circulation, and as a consequence the limb (or a portion of it) is deprived of its proper supply of blood, and it dies, or, as it is called, *mortifies* ; a

smart blow with a stick, though it does not break the skin, ruptures the small blood-vessels underneath it, blood escapes under the skin and causes swelling and discoloration—in fact, a *bruise*; or a man tumbles on some sharp instrument, a large artery is cut open, bright red blood spurts violently and profusely from the wound, and if help is not rendered speedily death results from *bleeding* or *hemorrhage*.

### RESPIRATION OR BREATHING (Fig. 4).

This is the process by which the dark impure blood gets rid of its poisonous carbonic acid, and at the same time becomes reddened, purified, and charged with wholesome oxygen. The organs of breathing are the *lungs*—right and left—and they are safely lodged in the cavity of the chest. When we draw in a breath, or *inspire*, the air rushes in through the mouth and nostrils and down a tube which you know by the expressive name of *windpipe*. The upper end of the windpipe is enlarged, and contains the organ of the voice; the lower end divides into two smaller tubes, one of which enters each lung, splitting up into smaller and smaller branches, like the twigs of a tree, until finally all the little minute tubes end in a multitude of very small pouches, sacs, bags, or *air-cells*. The two tubes into which the lower end of the windpipe divides, together with all their smaller branches and divisions, go by the name of *bronchi* or *bronchial tubes*; and when we inspire, or take a breath, the air rushes down them into the air-cells. The little air-cells are surrounded by, or rather imbedded in, a close network of capillary blood-vessels; and while the blood flows along these capillaries (from the pulmonary artery to the pulmonary veins, as previously described) it gives up its carbonic acid to, and at the same time takes oxygen out of, the air in the little air-cells. When we breath out, or *expire*, the air, rendered in its turn impure by the carbonic acid derived from the blood as well as by the loss of its oxygen, is driven out of the air-cells along the bronchial tubes, windpipe, and through the mouth and nostrils clear of the body. You may now realise how important it is that we should have good wholesome fresh air to breathe; and you can understand the evil of overcrowding, whereby the air becomes charged with an excess of poisonous carbonic acid, and deficient in that

which is essential to life, viz., oxygen; and you can appreciate the danger of croup and other diseases affecting the upper portion of the windpipe and tending to block it.

I must now tell you a little about the *mechanism of breathing*. You remember that the chest is formed, as regards the skeleton, by the ribs on each side, which are connected by pieces of gristle with the breast-bone in front, and jointed to the back-bone behind: the chest is bounded below, and separated from the belly, by a powerful muscular partition arched upwards, which is termed the *midriff* or *diaphragm*; and the cavity is further enclosed all around the sides by muscles which pass from one rib to another. It must also be borne in mind that the lungs themselves are extremely elastic. During *inspiration*, or the act of drawing air into the chest, the midriff descends at the same time that all the fore portion of the ribs and the breast-bone are drawn upwards; the cavity of the chest is thus much enlarged, and the air rushes down the windpipe into the lungs to fill the vacuum. During *expiration*, or the act of forcing the air out of the chest, the midriff ascends, the ribs and breast-bone are depressed, and the diminution of the cavity of the chest thus caused, together with the contraction of the lungs from their great elasticity, drives the air forcibly out of the chest along the windpipe. During health a person breathes or *respires* (that is, goes through the movements of inspiration and expiration) from fifteen to eighteen times a minute. The lungs are never completely emptied of air, even after very forcible expirations; but at every inspiration there is free mingling of the fresh air with that already in the chest.

### THE ORGANS OF EXCRETION.

A portion of the waste materials, the hurtful and useless *débris* (the ashes, so to speak, of the human machine) that result from the wear and tear of the different structures of the body, is got rid of, in the form of carbonic acid and some watery vapour, by the lungs. A good deal more of these waste and effete products of the different tissues and organs is got rid of by means of the skin and also by the kidneys; and for this reason the lungs, skin, and kidneys, are spoken of as organs of excretion—they get rid of or throw



out from the body those various impurities which result from the waste, decay, wearing out, or habitual work of all the different tissues and organs.

### THE SKIN.

A continual evaporation of water is going on from the surface of the body during life; and at different times, from great exertion, intense heat, or other causes, more water is poured out by the skin than can at once evaporate, so that it forms in drops and beads, as in *sweating* or *perspiration*. This water is separated from the blood by great numbers of little sweat glands that exist in the skin. When I say great numbers I mean millions. One authority calculates that two and a half millions, another that seven millions, are contained in the skin of an ordinary-sized man; but, however that may be, the skin pours out on the average in twenty-four hours, between sweating that you notice and constant evaporation that does not attract your attention, about two and a half pounds of water, and with this water is got rid of at the same time carbonic acid and a noxious substance called urea. You can now appreciate the great danger of an extensive burn from, for instance, an explosion of gas. The injury may not be deep, but if a large surface of the body is scorched just sufficiently to arrest the usual evaporation, then the system is unable to clear itself of the impurities that are constantly accumulating in the blood, and most serious illness, indeed often death, is the result.

But the skin is not merely an organ of excretion. It serves as a covering for the whole body, and to a certain extent protects from external violence the structures underneath it. It is so remarkably elastic, tough, and pliable, that it is admirably adapted for its office of shielding the deeper tissues from harm, at the same time that it admits of the greatest freedom of movement. It also helps, as it conducts heat badly, to maintain the warmth of the body; and last, not least, it is the principal organ of touch.

### THE KIDNEYS.

There are two of these organs—a right and a left—situated in the cavity of the belly, and placed one in each loin. They act as organs of excretion, and get rid of, on the average,

about forty or fifty ounces of water in the twenty-four hours, together with certain impurities and waste materials, such as urea and uric acid. The water, with the urea and other products of the wear and tear of the tissues dissolved in it, goes by the name of *urine*, and runs down from each kidney along a narrow tube into a reservoir situated in the pelvis and called the *bladder*, from which it is expelled as occasion requires.

### FOOD AND THE ORGANS OF DIGESTION.

Food may be looked upon as the fuel of the human machine. The blood, as you know, during its circulation through the body, not only serves to convey oxygen derived from the air we breathe, but also nutriment extracted from our various eatables to all the tissues and organs for their growth and repair. But our different articles of diet are not in their natural state fit to enter the blood direct, and it is the business of the organs of digestion therefore to extract all the suitable nourishment from the food which we swallow, and to render it into such a condition that it may be fit to pass into the blood and be carried all over the body to make up for the constant loss from waste, wear and tear, and decay.

The food is first of all subjected, in the mouth, to the action of the teeth, and also of a liquid that is poured into the mouth by some neighbouring glands, and which is called *saliva* or *spittle*. The food is cut up, broken, crushed, and ground down by the teeth, and at the same time being mixed up with the saliva is formed into a pulp which is suitable for swallowing. The saliva, moreover, serves the purpose of keeping the mouth moist, preventing particles of food continually sticking to the teeth, rendering the movements of the tongue easy, of dissolving portions of the food (so that we are enabled to taste them), and also of exerting a chemical action on certain parts of our diet.

The food is next, by the act of *swallowing*, forced by muscular action down the back of the throat along the gullet into the *stomach*. This is a bag of considerable size, which pours forth into its cavity from a multitude of little glands an acid liquid called the *gastric juice*. The food on reaching the stomach is subjected to the action of this fluid, and it is

so churned up by the movements of the stomach (which, as you may remember, contains involuntary muscle in its walls) that every portion of it becomes thoroughly mixed up with, and subjected to the action of, the gastric juice. A portion of the food is indeed straightway dissolved, and absorbed or taken up by the minute blood-vessels (capillaries) in the walls of the stomach; the remainder—converted into a thickish liquid called *chyme*—is forced on by the muscular action of the stomach into the *intestines*. These consist of a tube about 26 feet in length, along which the remnant of the food is gradually forced by the muscular action of the bowel itself, for *it* also has involuntary muscle in its walls. During its progress the food meets with, and is acted upon by, different juices or secretions; thus soon after it enters the intestine it becomes mingled with the *bile*, which is poured into the bowel from the *liver*, and with the *pancreatic juice*, which in the same way streams into the bowel from the *pancreas* or *sweetbread*; and as it passes onwards it mixes with the secretions of large numbers of minute glands that line the intestine itself. In this way the remainder of the nutritious portion of the food is dissolved or digested, and is taken up by the minute capillaries, or by other special delicate tubes for conveyance to the blood, which exist in the walls of the intestines. The unnutritious, indigestible remnant of the food is passed on and got rid of through the bowels.

#### ORGANS OF SECRETION.

The different liquids and juices that I have been speaking of in connection with the digestion of our food are of quite an opposite character to the fluids poured out by such organs as the kidneys and skin. The saliva, which is manufactured by the salivary glands; the gastric juice, which is poured forth from the numerous gastric glands that are lodged in the lining membrane of the stomach; the bile, which is produced by the liver; the pancreatic juice, a product of the pancreas; and the intestinal juice, which streams from the numberless minute glands of the intestine, are all liquids which are expressly formed in their special glandular manufactories (from materials extracted from the blood as it circulates through them) for the purpose of performing some special service in the interior of the body. The organ

which produce these important and serviceable liquids and juices—such as the salivary glands, liver, pancreas, etc.—are termed *organs of secretion*, as distinguished from the organs of excretion, viz. the lungs, skin, and kidneys, which separate the noxious products of wear and tear and decay from the blood in order to get rid of them and throw them out of the body.

When considering the different parts of the body,—the skeleton with its joints, the muscular system, the nervous system, and the organs of the special senses, the organs of circulation, the organs of breathing or respiration, and the organs of secretion and excretion,—remember that all these different portions of the human machine work beautifully together; that all the various structures of the body, though perfectly distinct, are fitted and arranged so exquisitely one with the other, that each system serves its special purpose with regularity and exactitude without interfering with the work of the others; and yet at the same time all the different parts are so beautifully adapted, or blended, so to speak, one with the other, that there are no rough irregular corners or jagged edges, and in the movements of the body—either of the limbs or trunk, or of the internal organs—the different structures glide smoothly and noiselessly one on the other.

*Fat* fills up the interstices or odd spaces of the body. It forms a layer underneath the skin which does away with any angularity of form, causes the main outline of the body to be made up of smooth and gentle curves, and assists very materially in preserving the heat of the body. It moreover serves in certain parts to diffuse pressure; thus there are pads of fat on the palms of the hands, the buttocks, and the soles of the feet.

The skin pours forth on its surface some material of an oily or greasy nature, which serves to keep it soft and supple, to protect it against the effects of prolonged moisture, and to check undue evaporation.

The various important organs which move during the performance of their functions, such as the lungs, heart, intestines, etc., are provided with a beautiful arrangement by which they glide smoothly and easily over the parts next to them; thus each lung has a closed but flattened delicate membranous bag interposed between it and the wall of the chest, one side of the bag being attached to the chest and the

other to the surface of the lung; the two layers of the bag, being moistened with an oily material, glide over each other with the utmost smoothness during the movements of breathing. In the belly there is a similar contrivance, one side or layer of the bag being attached to the wall of the belly, the other being reflected over and attached to the intestines and other organs in the cavity; the heart is enclosed in a tough fibrous case, and its movements are facilitated by a similar arrangement, one layer of the membranous bag being attached to the heart itself and the other to the fibrous case.

I might dwell much longer on the wonders of the human machinery, but time will not allow me to pursue further this portion of my subject. I can only hope that my brief description of the structure and functions of the body may be of service in enabling you to understand and appreciate the different methods of rendering first aid in cases of emergency.

### THE TRIANGULAR BANDAGE (Fig. 7).\*

Bandages—of which there are two principal kinds, the *roller bandage* and *Esmarch's triangular bandage*—are used for the purpose of covering wounds, and so protecting them from dirt and dust, the hot rays of the sun, flies and other insects, &c.; also for affording support to different parts of the body that may be injured, as, for instance, the slinging of a wounded arm; for applying pressure in order to arrest bleeding; for binding on and maintaining in their proper position dressings to wounds and splints to fractured limbs; and for checking undue muscular action.

*Roller bandages* consist of long strips of unbleached calico, linen, flannel, or some special material, and they vary in length and breadth according to the part of the body for which they are to be used; thus for the chest a large roller is required, about 4 or 5 inches wide, and 6 or 8 yards long, while for a finger a strip  $\frac{3}{4}$  inch wide, and about a yard long, is sufficient. It requires considerable practice to apply these bandages smoothly and evenly, and if they are not put on properly much harm may ensue from undue pressure or con-

\* Introduced by Professor Esmarch, and described in *The First Dressing on the Battle-Field*. Translated from the German by Dr. Thomas Guy.

striction by the tightening of some of the folds. Mortification of a limb may even result—indeed it has actually occurred—from this cause, the bandage being applied unevenly, and some of the upper folds fixed so tightly as to arrest the circulation. It follows from all this that roller bandages are more especially adapted for the use of professional men or trained nurses.



FIG. 7.—Esmarch's Illustrated Triangular Bandage. Of the three corners of the bandage, the two which are represented as hanging down are called the *ends*: the other uppermost corner being termed the *point*. Of the three borders, the long lower one is called the *lower border*; the other two being spoken of as the *side borders*.

For ambulance work, *Esmarch's triangular bandages* (Fig. 7), or *handkerchief bandages* are much more suitable; they answer all requirements; there is not the same risk or difficulty in



FIG. 8.—The Reef-knot.

using them as I mentioned in connection with roller bandages; and, above all, the manner of applying them can be learnt with the greatest facility.

These bandages are nothing more than triangular pieces of calico or linen, measuring about 4 feet at the lower border and 2 feet 10 inches at the sides ; and any number of them

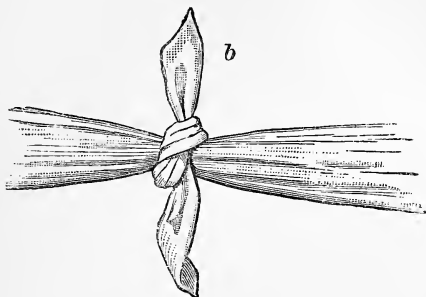


FIG. 9.—The “Granny.”

may be readily cut out of ordinary unbleached calico. Moreover, they can be readily improvised on emergency by simply folding good-sized pocket handkerchiefs or neck handkerchiefs across into triangular shape, and so forming true *handkerchief bandages*.



FIG. 10.—The Safety-pin.

The triangular bandage—whether ready-made or improvised—is used either *folded* or *unfolded*, according to the purpose for which it is required ; and the ends of the bandage may be fastened by either tying or pinning—if tied, the reef-knot (Fig. 8) should be used (because more secure) in preference to the “granny” (Fig. 9) ; if pinned, safety-pins (Fig. 10), if handy, should be chosen before ordinary pins, as they are more likely to hold fast without slipping during the movements of the patient. A *folded* bandage—that is, a bandage folded like an ordinary neck-handkerchief or cravat, by doubling the point down to the lower border and refolding it until the required width is obtained—makes a very convenient *small arm-sling* (Fig. 13), serves to bind on splints,

temporary or otherwise, for the support of broken limbs (Figs. 28, 29, 31, 32, 33), is useful for fastening compresses securely and tightly in their places in order to stop bleeding, is suitable for making an improvised "tourniquet" (Fig. 26), and is well adapted for bandaging wounds of the forehead, back and sides of the head, eyes, ears, nose, cheek, chin, jaws, and upper and lower limbs (Figs. 13 and 19).

The method of making a small arm-sling is given in the description of Fig. 13; the fixing on of compresses and of temporary "tourniquets" is explained in the Lecture on Bleeding; and the means of affording aid with bandages and splints in cases of broken bones are fully discussed in the



FIG. 11.—Bandage for Head  
(from before).



FIG. 12.—Bandage for Head  
(from behind).

*Directions.*—Take an *unfolded* bandage; double the lower border over so as to form a rim or hem about 1 in. or  $1\frac{1}{2}$  in. deep: then lay the bandage on the head, the point hanging down the back of the neck, the rim resting across the forehead close to the eyebrows; carry the ends backwards just above the ears, cross them at the back of the head, bring them around again to the lower part of the forehead and tie in a reef-knot: lastly, pull the point downwards so as to tighten the bandage, then turn it up towards the top of the head and secure it with a pin.

third lecture. In dressing wounds of the front of the face, of the eyes, nose, lips, or chin, the centre of the bandage—folded rather narrow—should be placed on the wound, the ends being carried around to the back of the head and tied. For wounds under the jaw and on the sides of the face, the middle of the bandage should be placed beneath the chin, the ends being carried upwards over the cheeks and secured at the top of the head. In dressing injuries of the forehead, back or sides of the head, the centre of the bandage should be laid on the wound, and the ends carried around to the opposite side of the head and tied there, or crossed, brought



back, and tied over the wound. Similarly, when the upper or lower limbs are wounded, the centre of the bandage should be laid on the injured spot, and the ends carried around the limb, crossed, brought back, and fastened over the wound (Figs. 13 and 19). An *unfolded* bandage makes an admirable *large* arm-sling (Fig. 14), and is especially adapted for bandaging the head for scalp wounds (Figs. 11 and 12), the chest (Figs. 15 and 16), back, hand (Fig. 13), foot (Fig. 18), the stump of a limb—a portion of which has been torn or blown away by an accident, or on the battle-field (Fig. 16), and (if used with a second bandage), also the shoulder (Figs. 13 and 16), and hip (Fig. 17).

The different ways of applying an unfolded bandage are explained in the descriptions of the various woodcuts (Figs. 11 to 18).

### FIRST AID TO THE INJURED.

*General precautions.*—You should always remember that when giving aid to the injured, you are affording but *temporary* help, with the hope of relieving the sufferer's pain, preserving his life, and preventing any aggravation or increase of his injuries, *until the arrival of medical assistance*. To begin with, there are certain *general precautions* which you should always bear in mind when helping an injured person, irrespective of the nature of the hurt, whether a wound, a broken limb, or other result of violence.

(a) People are liable to turn sick, giddy, and faint, when injured: so do not keep a patient standing, but on the contrary, put him to lie down, or at all events to sit, while you are attending to his needs, and if he should faint right away, lay him flat on his back, with his head on a level with, or rather lower than, his body.

(b) Persons who are injured suffer more or less from "shock": that is to say, they are to a greater or less extent, anxious, depressed, tremulous, pale, faint, chilly, the skin often feeling quite cool and clammy, and the sufferer complaining of cold and shivering: so you should therefore always avoid, as far as possible, undressing the patient. It is of course necessary to completely expose a wound before dressing it; and to lay an injury bare, so as to see it at its worst at once, and so that you can understand what to do for the best: but this may be accomplished with-



FIG. 13.—Bandages for Shoulder, Hand, Elbow; and a Small Arm-sling.

*Directions.*—For wounds of the shoulder, lay an *unfolded* bandage over the shoulder so that the point rests on the side of the neck and the lower border across the middle of the upper arm; carry the ends around to the inner side of the arm, cross them, bring them back and tie them on the outer side of the arm. Take a second bandage, *folded* broad, and place one end over the shoulder of the injured side; raise the arm gently, bringing it across the middle of the bandage hanging down in front of the chest; then carry the other end of the bandage upwards in front of the wrist, over the shoulder of the sound side, and tie the ends together behind the neck (thus making a *small* arm-sling). Finally, pass the point of the first bandage under the sling, double it back, and pin it at the top of the shoulder (thus completing the bandage for the shoulder). For wounds of the hand, lay the hand on an *unfolded* bandage, so that the fingers are directed towards the point, and the wrist rests on the centre of the lower border; turn the point backwards over the fingers to the lower part of the fore-arm; and lastly, wind the ends around the wrist, cross them over the point, carry them around again, and tie on the opposite side.

out stripping the patient. Thus, if the lower limb is injured, you should cut or rip up the seam of the trousers, and if needful, cut open the boot and stocking—do *not pull* them off. If the upper limb is wounded, cut or rip up the seams of the sleeves of the coat and shirt; and if it is the trunk which has sustained injury, you can generally expose the part by unbuttoning the coat, waistcoat, shirt or trousers. It may be necessary also to loosen portions of the clothing which appear to be fastened too tightly, and to interfere with the breathing or the circulation of any part of the body; such as the collar, necktie, waistcoat, braces, or, in soldiers, the tunic, waistbelt, or the other accoutrements.

It is possible that, after assisting an injured man to his home or to a neighbouring cottage hospital, you may be called upon to help in undressing him for bed; and in doing this you should be careful to take the clothes off the sound side first, and then to remove them gently (cutting or ripping them if there is the slightest difficulty) from the injured side. Should you, on the other hand, have to assist in dressing a patient, pull the clothes first very carefully over the injured arm or leg, and then proceed to dress the sound side.

(c) It is commonly thought that, because people who are injured frequently suffer from thirst and often become faint, depressed, and chilly, it is necessary to give them a quantity of brandy, whiskey, or other stimulant. This is altogether a wrong and mischievous idea, and the sooner you disabuse yourselves of it the better. Should an injured person turn very faint, or be much lowered and depressed by “shock,” then (*if there is no risk of bleeding*) a *small quantity* of wine, brandy, or other spirit, mixed with water, may be given with advantage; but otherwise stimulants are hurtful, and should be avoided. Indeed, if there is any danger of bleeding, stimulants aggravate the danger by increasing the force of the heart and the circulation.

The following remarks by Surgeon-General T. Longmore,\* in connection with this subject, are just as applicable to those injured during times of peace, as to soldiers wounded on the battlefield. “The patient who has fallen from shock, or from faintness, will recover from gradual restoration of circulatory action where he lies, or may be carried away on a stretcher without material harm resulting from his condition; in some

\* *Gunshot Injuries.*

particular instances even with more advantage than if he had been roused from it by the administration of some of the usual remedies.....Water is the natural beverage for relieving thirst, and under ordinary circumstances is the only one that should be used among wounded in the field. In warm weather the coldest water from a spring will be the most grateful and the most appropriate; in winter, cold drinks are in a great degree hurtful. The depression of nervous energy, and of the temperature of the surface of the body, by exposure to cold; the aggravation of these depressed conditions when there has been loss of blood, naturally indicate that whatever beverages are given should be in a state to add warmth to the frame, and within due bounds, vigour to the circulation.

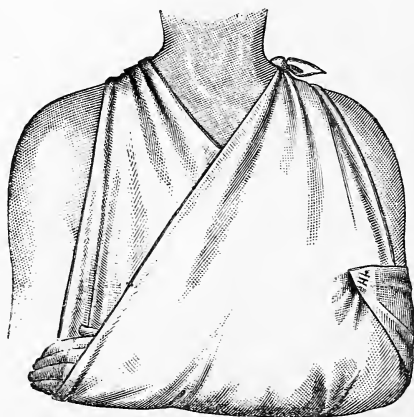


FIG. 14.—Large Arm-sling.

*Directions.*—Take an *unfolded* bandage, place one end over the shoulder of the sound side, allowing the other end to hang down in front of the patient, and drawing the point well behind the elbow of the injured arm, carefully bend the latter and place the fore-arm across the middle of the bandage, then raise the lower end of the bandage, carrying it over the shoulder of the injured side, and tie both ends behind the neck, finally bring the point well around the elbow and pin it in front. The sling should be so arranged that the hand lies at a higher level than the elbow.

Warm weak tea or coffee, warm broth, are really the only suitable beverages under such circumstances.....if circumstances ever admit of their being given, the opportunity should not be neglected. They are restoratives of vital importance. They become all the more essential when a

wounded soldier has remained long without any attention, when he has been lying on wet ground, or exposed to rain or snow. Spirituous stimulants may often be given with benefit under these special circumstances, when other liquid restoratives are not at hand; but they should be administered cautiously, only in small quantity, and then diluted with water. If it be possible to combine them with heated water, their effect will be all the more advantageous."

(d) The injured man should have the benefit of as much fresh air as possible, so do not allow idle and ignorant people to crowd around him: he should on no account be teased, pulled about, moved, or even touched unnecessarily and aimlessly, therefore consider calmly, but quickly withal, what is best to be done, and then act promptly and without any fuss: he should, unless the case is a trivial one, be placed under medical treatment as soon as practicable, therefore it is your duty to see that a messenger is at once despatched for a doctor, or that steps are taken to carry the patient in a proper manner to his home, the hospital, or other spot where he may receive professional assistance.

### THE FIRST DRESSING OF WOUNDS.

Wounds (that is to say, injuries in which the skin, flesh, or other soft tissues are laid open) differ considerably in character according to the way in which they are caused: thus, some are clean cut, or *incised*, as the gashes made by razors, knives, and swords; others are torn, or *lacerated*, the edges of the wound being jagged and irregular; or they are accompanied by much crushing or bruising of the parts, and so are called *contused* wounds; or they are deep, out of all proportion to their breadth, such as the injuries caused by stabs, sword and bayonet thrusts, blows from picks, &c., and are spoken of as *punctured* wounds; and, lastly, there are *gunshot* wounds, which, as the name implies, are caused by explosive weapons, such as rifles, cannons, sporting guns, and pistols.

You never know where you may be, or under what circumstances you may be placed, when called upon to give assistance in cases of wounds; you may be at home, with plenty of clean water, sponges, towels, and sticking plaster at hand; you may be down a coal-pit, with nothing by you

suitable or convenient; or you may be in all the turmoil and excitement of the battle-field. But in any case your attention should be directed to the cleansing of the wound from all dirt and impurities; the arrest of bleeding; the replacing of the edges of the wound as nearly as possible in their natural position; and, lastly, the application of a simple *clean* dressing by means of a handkerchief-bandage, in order



FIG. 15.—Bandage for Chest—from before.

*Directions.*—Take an *unfolded* bandage; lay it on the chest, placing the point well over the shoulder and the lower border across the front of the body; carry the ends around and tie them over the back-bone; draw the point down behind the shoulder and tie it to one of the ends of the knot (as shown in Fig. 16), or pass it under the knotted part of the bandage, double it back and pin. An unfolded bandage may be applied to the back in a similar manner.

to *protect* the wound from cold winds, hot rays of the sun, insects, dust, and other impurities; to *support* the injured part; and to make the patient as comfortable as you can until he has the benefit of skilled aid.

*Cleaning the wound.*—It is necessary to pick out any pieces of glass, bits of coal or stone, splinters of wood, fragments of clothing, etc., which may be sticking in the wound; and to

remove dirt, soil, mud, sand, and similar impurities (if you are in a position to obtain *clean* water) by thoroughly washing the wound and the surrounding parts. Spring water, the water of rivers and brooks, or even sea-water, may be used for this purpose ; but rather than use dirty water it is better not to wash the wound at all, as by so doing, you may poison it ; and, for the same reason, when dressing wounds you should always be careful to work with clean fingers. If

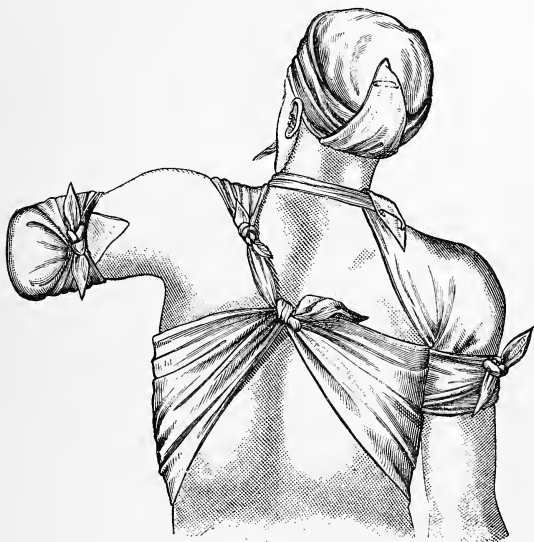


FIG. 16.—Bandages for Chest, Shoulder, Head, and Stump of Arm—  
from behind.

*Directions.*—To bandage the stump of a mutilated limb, cover the end of the stump with an *unfolded* bandage, drawing the point up on one side of the limb and the lower border on the other ; then carry the ends around the limb and tie them over the point so as to secure it, or cross them over the point and tie on the opposite side. (See also Figs. 11, 12, 13, 15).

you are at home, or otherwise conveniently situated, it is best to add a little carbolic acid to the water (about 1 to 40). The articles used in washing the wound, as sponges, towels, handkerchiefs, or pieces of linen, should be scrupulously clean ; indeed, to ensure cleanliness when large numbers of wounded have to be attended to, as in military campaigns,

it is safest to avoid the use of sponges altogether, and to cleanse the wounds with fresh clean bits of tow, linen, or lint, throwing the latter away immediately after use. The water should be *cold*, for the purpose of checking the bleeding.

In the case of wounds which are perfectly clean and free from all impurities, washing is not needful; and *when a clot of blood has formed in a wound, you should on no account disturb it* either by washing or meddlesome fingers, as you may thereby start fresh bleeding. If the wounded part is hairy—as, for example, is the case in scalp-wounds\*—it is better, should you have time, and happen to have a pair of scissors about you, to clip off all the hair immediately around the injury.

*Arrest of bleeding.*—Should a large blood-vessel be injured—the bright red blood spurting violently out (as in bleeding from an artery), or dark purple or blackish blood flowing down in a continuous stream (as in bleeding from a vein)—then all your efforts must be promptly and vigorously directed to stopping the bleeding. In such an emergency, your entire and undivided attention must be given to the arrest of the bleeding, in order to save the patient's life; and the methods of doing this will be explained to you in the next lecture. In the generality of wounds, however, such as you so frequently meet with, the bleeding is not profuse; the red blood oozes, drops, trickles, or runs off from the entire raw surface of the wound (bleeding from the capillaries), and the bleeding is readily checked by cold water, the pressure of the dressings or bandages, and a raised position of the injured part.

*Replacing the edges of the wound in their natural position.*—In wounds of the head a portion of the scalp is sometimes found hanging down; and in other injuries, particularly of the lacerated or torn variety, there is often considerable displacement of the skin. I need hardly say that the injured parts—freed from all grit, dirt, splinters, &c.,—should be put back in their proper position as quickly as possible, and kept in place, as far as practicable, by a simple dressing and a bandage. This specially applies to wounds of the face, so as to lessen the risk of disfigurement; indeed in all the clean-cut wounds—even in slight ones—where there is much gaping and difficulty in keeping the edges together, the sooner the aid of a surgeon is procured the better, so that the wound

\* The skin covering the upper portion of the head is termed the *scalp*.



may be stitched; thereby rapid healing of the wound will probably follow, and disfigurement will be lessened or altogether avoided.

In wounds of the belly, accompanied by the protrusion of a portion of its contents, as, for instance, a part of the intestine, the protruded parts should, if practicable, be washed with warm water, and carefully pressed back into their place, the patient should be placed in a comfortable lying-down position, and medical aid procured as speedily as possible.

*Dressing and bandaging of the wound.*—Fold up a piece of

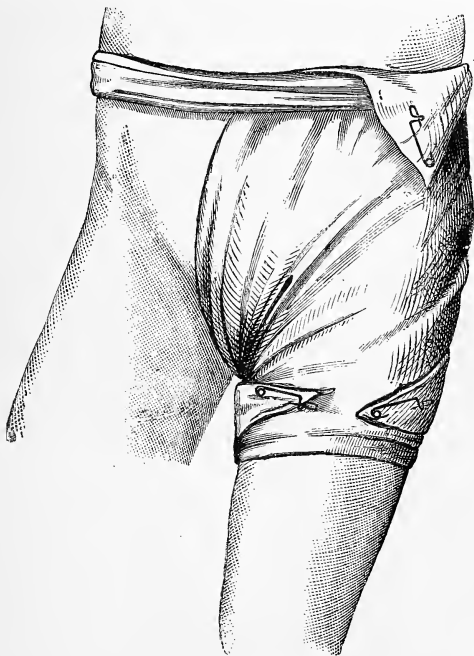


FIG. 17.—Bandage for Hip.

*Directions.*—For wounds of the thigh, tie a bandage, *folded* narrow, around the waist like a belt (this is not required if the patient has an ordinary waist belt). Take a second bandage, *unfolded*, and apply it with the point directed upwards, the centre on the wound, and the lower border across the front of the thigh; carry the ends around the thigh, cross them, bring them back and fasten them by pinning or by a reef-knot; pass the point underneath the waist-band, double it back, and pin it.

lint, linen, muslin, shirting, gauze, or any fragment of rag or handkerchief that is *clean* and soft into a pad; wet it, if you have the opportunity, in cold *clean* water; then apply it smoothly to the wound, and bind it on with your triangular bandage, handkerchief, or scarf. That is called a *cold water dressing*, and it is the best application in cases of *contused* and *lacerated* wounds; though very simple, it is amply sufficient, in the majority of skin and flesh wounds, to keep the edges of the wound in place, to stop the bleeding, and to protect the wound from insects, dust, and other impurities. Should carbolic acid be available, it is better to add a few drops (about 1 to 40) to the water before wetting your pad. If clean water is not to be got easily, as may happen, for instance, on the battle-field, or in the depths of a mine, you may use the same materials—lint, linen, &c.,—without wetting them—that is *dry dressing*; this kind of dressing is usually applied in cases of *incised* wounds; but it has, however, the double disadvantage of being somewhat irritating to the wound and of sticking firmly to the raw surface and edges, so that its removal, when surgical help is obtained, is only effected with a good deal of trouble and with considerable distress to the patient. The disadvantage of dry dressing is not so noticeable in civil life, for the services of a doctor can usually be procured within reasonable time; but it is very different in military campaigns, when it may be long, perhaps several hours, before an injured soldier reaches a position where he can have the first simple dressing—stuck fast and close to the wound, by that time—removed. It is urged, therefore, by military surgeons, that, in the absence of clean water, other means should be adopted to moisten the first dressings of wounds. Deputy Surg.-Gen. R. Wolseley suggests that the lint or bandage first applied to wounds received on the battlefield should be wet with Rangoon oil, which is used for cleaning rifles, and forms part of a soldier's equipment. In the battles around Paris, in 1870-71, charpie—a soft downy material, made by scraping and unravelling linen—moistened with glycerine and water “was found to be the best application for immediate use to wounds”;\* and in the Ashanti war, a little simple ointment was smeared over the lint used as a first dressing to prevent the sticking of the wounds.

\* *Gunshot Injuries*, Surg.-Gen. Longmore.

In the case of clean cut (or *incised*) wounds, should you be at home, near a chemist's shop, or in any place where sticking plaster is close at hand, it is better to draw the edges of the wound well together, and strap them across with strips of plaster, before putting on your pad; taking care to leave spaces between the strips, so as to allow room for any discharge to escape.

Having applied your pad, and fixed it securely by put-



FIG. 18.—Bandage for Foot.

*Directions.*—For wounds of the foot, spread out an *unfolded* bandage; place the foot on the centre of it, with the toes directed towards the point; turn the point over the toes to the back of the foot or the instep; raise the lower border behind the heel, draw the ends forward, crossing them on the top of the foot and tying on the sole, or crossing them again on the sole and tying on the top of the foot or around the ankle.

ting on a triangular bandage or handkerchief in one or other of the ways, according to the position of the wound, which I have already described (p. 38, etc.), and illustrated by diagrams (Figs. 11 to 19), you should next see that the *injured part is placed in an easy position and properly supported*, so that the patient may walk away—or be carried off, or assisted along—from the scene of the accident with as little pain and discomfort as possible, and without any aggravation of his injuries. Thus, if the upper limb is wounded, it should be placed in a sling (Figs. 13 and 14); and if it is necessary to place the patient in a lying down position (on a stretcher for instance), he should be laid either on his back, or on the uninjured side; if the lower limb is injured, it should be

propped up by folded clothes, uniform, straw, hay, or a knapsack, and, if necessary, further supported and steadied by being bound to the sound leg, the patient being laid on his back with a slight inclination towards the injured side; if the chest is injured, more especially if the breathing is difficult, the patient should be placed in a half lying down position, with his head and shoulders well raised and his body inclined towards the injured side; if the belly is wounded, the patient should be placed in the lying down position with his knees well drawn up (and supported, if needful, by folded clothing, &c.)—on his back, if the wound is in front, but on the injured side, if the wound is at the side; if the head is wounded, and it is necessary to place the

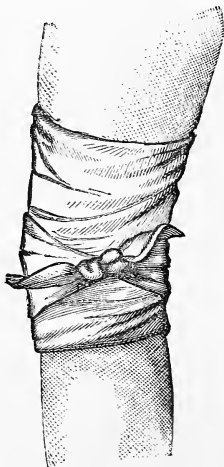
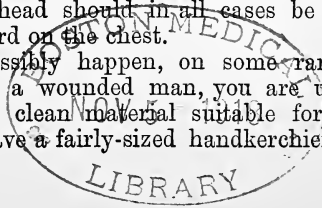


FIG. 19.—Bandage for Knee.

patient in a lying down position, care must be taken that the injured part does not press against the stretcher or conveyance; and lastly, when carrying a patient in the lying down position, his head should in all cases be kept low and not pressed forward on the chest.

It may possibly happen, on some rare occasion, that, meeting with a wounded man, you are unable to lay your hand on any clean material suitable for a dressing; but should you have a fairly-sized handkerchief, you can always



improvise a triangular bandage, which, properly applied, will serve as a protective covering to the wound, and, if you are luckily able to wet it with clean cold water, it will keep the injured part cool and comfortable until medical assistance is procured.

Before leaving this subject, I wish to warn you of the risk of totally neglecting *slight* wounds, such as small cuts, lacerations, abrasions, pricks, and scratches, which—though annoying, and often very painful—are not serious enough to interfere with your work. Splinters, bits of grit, &c., unheeded at first and left imbedded in the flesh, often lead to inflammation and the formation of a “gathering” or abscess; small cuts and trivial scratches, altogether neglected, frequently become poisoned by the entry of dirt and other impurities with a similar result, viz., inflammation and abscess; and so through want of the simplest precautions, many a finger has been lost, many a hand crippled, many a large abscess formed, and many a workman unfitted for labour and forced to depend, during several weeks, for subsistence on his club or the parish. Therefore, in *slight* injuries, which are everyday occurrences with most of you, be careful to pick out any splinters or pieces of grit, and wash away, if necessary, any dirt that may be present; and then bind a strip of clean rag, or a folded handkerchief over the wound to prevent the entrance of dust or other impurity. Perhaps you may have some difficulty in doing all this in the midst of your work; but on your return home, after your day’s employment, you should take the opportunity—when having your usual wash—to carefully cleanse even the most trivial scratches and abrasions with warm clean water (to which a little carbolic acid, if you chance to have any, may be advantageously added), afterwards strapping the injured part with sticking plaster, and binding it over with a strip of clean linen or a folded handkerchief; and this should be done every evening at the end of your day’s labour. I have recently seen two workmen who suffered from abscesses in the arm-pit, and another who lost a portion of a finger, from neglecting these simple precautions.

## FIRST FIELD DRESSINGS.

Such great numbers of injured men need assistance on the battle-field; so destitute are troops on active service of anything soft, clean, and suitable for application to wounds; and so difficult is it often to obtain, in the midst of military manœuvres, even the simplest appliances just when most urgently required, that it is very necessary all soldiers, engaged in military campaigns, should be provided with such materials as are best adapted for the first simple dressing of wounds. Accordingly, in the present day, the troops of many nations—but more particularly, I think, the military forces of Germany—are supplied with small and conveniently shaped packets of a few useful articles (such as a triangular bandage, lint, pins, &c.) which are carried or sewn in some special part of the uniform. Our own soldiers, in the Ashanti War, were provided with a first field dressing, which consisted of a triangular bandage, a packet of lint smeared with simple ointment and enclosed in waxed paper, two safety pins, and some ordinary pins, all these articles being made up into a small flat parcel (measuring 4 in. by  $3\frac{1}{2}$  in. by 1 in.) covered with waxed paper, and carried in a breast pocket on the left side of the tunic. The first field dressing packet now adopted for use in the British service is one that was devised by Surg.-Gen. Longmore, and is composed of two pads of carbolised tow (that is, tow impregnated with wood tar to which 10 per cent. of carbolic acid has been added), measuring, dry, 4 in. by 3 in. by  $\frac{1}{8}$  in.; a carbolised gauze bandage, 2 yards long and 4 in. broad, with one safety pin; a triangular bandage of unbleached calico, of the usual size, folded and fastened together by four ordinary pins; a piece of tin-foil, measuring  $7\frac{1}{2}$  in. by 10 in.; and a cover of parchment paper, secured by flour paste impregnated with  $\frac{1}{2}$  per cent. of perchloride of mercury; the whole of these articles being arranged in a little parcel weighing only 4 oz., and measuring only  $4\frac{1}{2}$  in. by  $3\frac{1}{4}$  in. by  $\frac{7}{8}$  in.

The first field dressing packets are free from disagreeable smell, as the two coverings—the inner one of tin-foil, the outer one of parchment paper—effectually prevent the escape of any tarry odour from the carbolised pads; the packets also can be kept or stored up for several years without being

any the worse, for the tin-foil covering stops evaporation of the carbolic acid, &c., with which the pads of tow and gauze bandage are impregnated, and also protects the dressings themselves from the effects of external damp or moisture; moreover, the outer casing of parchment paper, besides retaining the various articles of the packet together in a neat and handy little parcel, serves to keep out dust, sand, dirt, &c.; to save the inner envelope of tin-foil (which is readily torn) from being ripped by contact with sharp, rough, or pointed hard substances; and lastly, it is itself a suitable material on which to print the list of the contents of the packet and the directions for opening it. The flour-paste used for fastening the parchment-paper covering is prevented from going bad and secured from the attacks of insects by the perchloride of mercury with which it is impregnated.

As to the use of the different articles in the packet—the carbolised pads of tow may be applied either separately to the two wounds caused by the entrance into, and exit from, the body of a rifle bullet; or they may be used, placed together, as a first application to a sword cut as long as 7 in., or to a shell wound as large as 3 in. broad by 5 in. long; the tin-foil—if it is thought desirable—may next be carefully laid over the tow, as it serves to keep the pads moist, if these have been steeped in water before their application, and in any case prevents the evaporation of the carbolic acid from the dressing—both of which points seem of considerable importance, as it may be several hours or even a day or two before the patient has a chance of having his hurts again attended to; the gauze bandage is used with the safety pin to secure the dressing in its proper position and to afford support to the injured part; and the triangular bandage is used, according to circumstances, either to cover and fix the dressing with greater security, to make a sling for the arm, or to bind on splints.

Now, if every soldier of an Army Corps, in time of war, is provided with one of these first field dressing packets, placed in a particular part of his uniform which is known to all and easy to get at, materials for a simple temporary dressing will always be at hand—no matter under what circumstances injured soldiers may be situated—by which wounds may be covered, protected from cold, insects, dirt, and other impurities, and the injured parts supported, until the patients can have their hurts attended to; and the tar and carbolic acid

with which the dressings are impregnated will prevent those putrefactive changes which are so apt to be induced in wounds by the dirt, impurities, and unhealthy influences to which soldiers, during active service, are unavoidably exposed. A supply of these little packets was forwarded for the use of our troops during the military operations in Egypt and Bechuanaland; and Surg.-Gen. Longmore tells me that on examining some of the packets which were taken out to the Soudan and brought back after the Soudan expedition returned, he found the parchment paper and tin-foil covers, in spite of the heat, had prevented all escape of tarry material and carbolic acid from the dressings they enclosed.

It would doubtless be an improvement if the triangular bandages in these packets were "illustrated"—that is, marked by diagrams shewing the methods of applying them—such as Esmarch's bandage (Fig. 7), the bandage supplied by the St. John Ambulance Association, and the bandage issued by the St. Andrew's Ambulance Association. It is very important, too, that the packets should be carried securely in some particular part—settled by the authorities—of the uniform; and *not* in the knapsack or valise, or it will inevitably be missing when most urgently needed. During the Ashanti war, the packets were carried within an inside pocket in the left breast of the soldier's tunic; but Surg.-Gen. Longmore now suggests that a suitable pocket may be made, with a flap for buttoning over it, outside the left breast of the tunic. Surg.-Major Evatt, on the other hand, thinks that there is room for a small leather pouch on the waist-belt, on the left side, in which the packets could be carried. But whichever position may seem the most suitable, eventually, to those in authority, "it is," as Surg.-Gen. Longmore remarks, "very important that a field dressing packet should be so placed that every one, whether surgeon, orderly, or soldier, should know where to find it, and should be able to get at it without difficulty, in case of need."\*

\* Remarks on "First Field Dressing Packets," by Surg.-Gen. Longmore. *Army Med. Dep. Reports*, vol. xxv.



## LECTURE II.

## BLEEDING OR HÆMORRHAGE.

The general direction of the main arteries indicating the points where the circulation may be arrested by digital pressure or by the application of a tourniquet—The difference between arterial, venous, and capillary bleeding, and the various extemporary means of arresting it—First aid in cases of internal bleeding.

I WILL try and explain to you this evening the best ways of giving assistance in cases of bleeding or hæmorrhage: and if you will bear in mind what I told you in the last lecture about the organs of the circulation—the heart, the arteries, capillaries, and veins—you will more easily understand my remarks. Remember that the heart acts as a strong pump driving bright red healthy blood through a number of tough elastic tubes all over the body to every tissue and every organ. These tubes, or arteries, divide and branch again and again, thereby becoming smaller and smaller until they at last end in an immense network of extremely thin and minute tubes—so small that they can only be seen with the aid of a microscope—called capillaries. The blood flows on through the capillaries, and these join together and gradually unite into larger tubes which pour the blood, now dark, and impure, into the thin flabby veins. The veins convey the dark blood back to the heart, whence it is forwarded on to the lungs to be purified before it is returned—bright red once more—to the left side of the heart to be driven again over the entire body.

Now, you observe that the circulation of the blood consists in the blood being driven through a complete system of tubes; and therefore if there is any escape of blood, or *bleeding*, one or more of the tubes must have given way. The quantity of blood lost, too, will depend on the size and number of the tubes injured, as well as the force with which the blood is driven along them; and the colour of the blood and the way in which it flows out of the wound will depend on the particular portion of the system of tubing that is injured. Thus, if an artery is opened, bright scarlet blood

spurts violently out in jets for a considerable distance—the red stream rising and falling like the play of a fountain—forcibly and directly driven by the strong pump action of the heart at a pressure of about four pounds to the square inch ; \* if a number of the small capillaries only are broken, then red blood trickles or oozes out, not from any one point, but from the whole raw surface of the wound : whereas if a vein is injured, dark purple or blackish blood flows out in one steady sluggish continuous stream.

Coming to the practical question, how can you give help in cases of bleeding ? you will easily understand—still bearing in mind the general plan of the circulation—that *pressure* firmly applied to the injured tube is the best way of stopping the leakage of blood—pressure applied, of course, on the side of the wound from which the blood flows. Thus, in bleeding from an artery you would apply pressure on the side of the wound *nearest the heart*—that is in the limbs *above* the wound ; in bleeding from a vein you would on the contrary, apply the pressure on the side of the wound *farthest from the heart*, that is in the limbs *below* the wound ; and in bleeding from the minute capillaries, as in scratches, abrasions, and simple flesh wounds, you would apply the pressure to the whole of the raw and bleeding surface.

Second in importance only to *pressure*, as a means for the temporary arrest of bleeding, comes *position*. In health, when the heart and blood-vessels are sound, the circulation keeps steadily going on, and, no matter what position we are in—standing, lying down, or otherwise—the blood never sinks down or accumulates in the lowest or most dependent parts of the body. Thus, when in the erect position with the arms hanging down, the blood does not gravitate towards the hands and feet, because the column of blood in the arteries and the column of blood in the veins mutually balance each other, and the force that drives the blood *down* the arteries of the limbs (the pumping action of the heart) lifts *up* the column of dark blood in the veins. Once, however, let the balance of the circulation be destroyed, once let any of the blood-vessels be opened, then the blood tends to gravitate and rush down out of the wound—that is, when the injury is in a dependent part of the body ; and for this reason it is

\* This accounts for the peculiarly violent and dangerous character of arterial bleeding. In the veins the pressure of the blood current is much less—only about a quarter of a pound to the square inch.

always very important, in a case of bleeding, to *elevate or raise up the wounded part above the level of the trunk.*

Another resource in cases of bleeding is the application of *cold*, in the shape of cold water, ice, or cool fresh air. This acts by causing contraction and diminution in size of the arteries and capillaries at the seat of injury.

Lastly, there are certain astringent substances, or *styptics*, as alum, steel drops, and powdered galls, which have the effect of clotting the blood, and causing shrinking of the blood-vessels, when applied to the raw surface of a wound. Your resources, then, for the temporary arrest of bleeding are, first and foremost, *pressure*; then, next in importance, *position*; afterwards, I place *cold*; and lastly, as they may occasionally be useful, *styptics*. I must now show you how to apply these different means for the arrest of bleeding; and first of all I will consider the methods of giving first aid in

#### ARTERIAL BLEEDING OR HÆMORRHAGE.

If you refer to the diagrams, you will be able to follow me better as I point out the direction in which some of the more important arteries run. Commencing with the upper part of the body, you see that a large artery ascends on each side of the body, you see that a large artery ascends on each side of the neck towards the head (Fig. 6). If you draw a line from the joint between the collar-bone and breast-bone to the angle of the jaw, that will show you the position of the artery. Feel for it in your own necks, and you will, after very little searching, feel it beating under your fingers. These are called the carotid arteries (you may have seen the name mentioned in the accounts of suicide by cutting the throat); and they split up into numerous smaller branches which carry blood to the brain inside the skull, and to the face, scalp, and other structures outside the skull. One branch courses over the side of the lower jaw-bone—about the middle of it—to supply the face with blood, and several others supply the scalp; one runs up the forehead above the eyebrow, another in front of the ear over the temple, another behind the ear, and yet another up the back of the head. All these spread about, dividing into smaller branches and communicating with each other and with corresponding arterial branches from the opposite side of the head so as to form a large network underneath the scalp.

*Arterial bleeding from wounds of the head.*—We often meet with men who are badly cut and bruised about the head either by tumbling on rails or other hard material; or by dirt, rock, or coal coming down on them while working in the colliery; or by blows from sticks or stones in some drunken row, the scalp being torn, and the bright red blood spouting out for a distance of one or two feet from an injured artery. Most of you have seen such cases, and if working in the colliery have probably tried to check the bleeding by pushing tobacco into the wound, whilst in other instances the flour bag has been resorted to, and the man's head covered with flour, making a matted horrible sticky mess very troublesome to get off. Such means are dirty, unreliable, and unsafe; for, though the bleeding may perhaps be checked for a time, it will in all probability break out again, and very likely the wounded artery will begin spouting afresh precisely at the time when no assistance is at hand. I met with a case of this sort recently; bleeding recurred quite unexpectedly a week after the accident. Now you can easily render valuable help in these accidents. You can at once stop the bleeding completely by pressing firmly with your finger on the spot from which you see the blood spouting, for by so doing the wounded and bleeding artery is quite compressed, squeezed, and closed between your finger and the hard skull of the patient, and any escape of blood from it is quite impossible so long as the pressure is kept applied. Here then you stop the bleeding by *pressure with the finger*, or, as it is sometimes called, *digital compression*; and if the doctor happens to be close at hand you can keep the bleeding under in this way until he takes charge of the patient. But if, as is usually the case, the patient has some little distance to go home, or he has to be assisted or carried to the neighbouring hospital or surgery, then it becomes—to say the least—irksome and inconvenient to keep on pressing his head with your finger. Pressure must still be kept on the wounded blood vessel, but in another way. You must make a pad of something—whatever is at hand—a folded handkerchief, a piece of torn clothing doubled up, wadding, tow, linen, lint, flannel, or hay rolled up hard, a piece of smooth stick, or a cork, or anything else suitable, and fix it firmly and securely on the wound by means of a bandage, so that it presses on the injured artery and keeps it from spouting. If you have time, and the material at hand is suitable, you should make

your pad of a somewhat conical shape, and press the narrow part of it direct on to the wound: you can do this by doubling up a small piece of the lint, or whatever substance you are using, and pressing it firmly down into the wound, then putting a larger piece on the top of it, a broader bit still over that, and so on until your pad reaches about an inch in thickness, and lastly you fix it tightly and securely in its place by bandaging. It does not very much matter how you put on the bandage, providing you so arrange it as to keep the pad firmly and tightly in its proper position, and maintain constant strong pressure on the wound. But it requires a little tact and care frequently to fix the pad on safely, more particularly if the wound happens to be on the side of the head: in this case lay the centre of your triangular bandage (folded narrow) on the opposite side of the head to the wound, bring it round and cross it over the pad, bringing one end up towards the top of the head and the other below the chin—much as if you were tying up a parcel—and tie the ends together at the sound side; or you may twist the bandage over the pad, turn the ends back, and tie on the sound side; or simply carry the ends over the pad and fasten as before; or if you have two bandages, you can carry the first one around the fore and back parts of the head, and the second one over the top of the head and under the chin, crossing or twisting them both over the pad. Similarly, in bleeding from the forehead, top and back part of the head, you had better place the middle of the bandage on the part of the head opposite the wound, then carrying the ends towards the wound, either twist them on the pad, turning them back again, or merely cross them over the pad carrying them forward, and tie them on the sound side of the head. In this way, if the wound is on the top of the head, the knot as well as the middle of the bandage is under the chin; if it is the forehead that is bleeding, the knot and middle of the bandage lie on the back of the head; and if the injured artery is at the back of the head, the knot and middle of the bandage are placed on the forehead.

I wish you to practice the making of small pads and the fixing of them on different parts of the head with your triangular bandages. But accidents always happen unexpectedly, and when your help is wanted in earnest you are not likely to have an illustrated triangular bandage, with a paper of instructions neatly folded and pinned, in your

pocket. You must use your wits in such a case, and make anything that is most handy and suitable do duty as a bandage—a pocket-handkerchief, a scarf, or neck-handkerchief would do ; or a brace, a garter, or a leather strap might serve the purpose.

You see that in the way I have described, bleeding can be checked by *pressure with a pad and bandage* ; and if you do your work properly a man dressed in this way can with perfect safety wait a long time for his medical attendant, or be conveyed either to his home or a neighbouring surgery.

*Arterial bleeding from wounds of the face.*—You may be called upon to give assistance in cases of injuries of the face, such as cuts and lacerations of the lips and cheeks, accompanied by smart arterial bleeding. Now remember that the artery which supplies the face with blood runs (one on each side) over about the middle of the lower jaw ; if you try and find it you will easily feel it beating on yourselves. You can check the bleeding in such cases by squeezing and pressing the artery firmly against the jaw-bone with your finger or by means of a pad and bandage. If you use a pad be careful to fix it on securely, the bandage being carried from under the chin to the top of the head, crossed, and brought down to be tied beneath the chin. You may also apply pressure at the spot where the injured artery is spouting, by putting your forefinger inside the cheek or lip, as the case may be, and your thumb outside, and squeezing the wounded vessel firmly between them. Here again always use your fingers first, and then think how you can best make and apply your pad.

*Arterial bleeding from wounds of the neck.*—I have already described to you the position of the carotid arteries which run one on each side of the neck up towards the head. Wounds of these large vessels are generally fatal at once from loss of blood, and excepting on the battlefield, are usually the result of attempts at suicide or murder. If any of you should ever happen to be at hand in such a terrible emergency, you must do your best to check the bleeding by pressing the injured artery with all your strength backwards against the spine. You can do this either by pressing with your thumb or fingers on the side of the wound nearest the heart (that is, in this case, *below* the wound, Fig. 20), or by pressing on the broken spouting blood vessel *in* the wound. In either way your object is to compress the artery firmly against the spine until medical assistance arrives. It is, of

course, plainly impossible to fix on a pad and bandage in an injury of this kind. Your only chance of stopping the bleeding is by digital compression, and to apply it with any chance of success you must act with the greatest promptitude, coolness, determination, and courage; and you must apply very strong and continued pressure, or the blood will be forced by the heart's action through the large wounded artery.



FIG. 20.—Digital Compression of the Carotid Artery.

I now come to the upper limbs. Referring to the diagram (Fig. 6) you see that each arm is supplied with blood by a large artery which lies deep behind the collar-bone, and crosses over the first rib down into the armpit. You can, by pushing your fingers firmly down behind the middle of the collar-bone, feel the beating of the artery; and you can find it also lower down in its course by pushing your fingers up into the armpit and pressing towards the upper end of the arm-bone. From the arm-pit the vessel can still be felt in its position along the inside of the arm, its direction corresponding pretty closely with the seam of the coat sleeve. It lies close along the inner edge of the large muscle of the

arm, and reaches to a little below the front of the bend of the elbow, where it divides into two branches, one of which extends down the outer side, the other down the inner side of the fore-arm. You can feel both these arteries beating above the wrist, particularly the one situated on the outer side of the fore-arm, for it comes so close to the surface in this part of its course that its beating can be easily felt, and indeed, often as easily seen. Wherever an artery is sufficiently near the surface of the body, its beating, pulsation, or pulse, may be readily felt and in many instances seen, but the expression *the pulse* is generally applied to the beating of the artery situated on the outer or thumb side of the fore-arm just above the wrist.



FIG. 21.—Digital Compression of the Subclavian Artery.

The two arteries of the fore-arm pass on into the hand where they end by communicating with each other in such a way as to form two curves or arches, one deeper than the other, across the palm, from which smaller branches are distributed to the fingers.

I advise you to study the position of the different arteries



with the aid of the diagram before you, and also to feel, whenever you have the opportunity, for the beating or pulsation of the vessels themselves in your own arms or in the arms of your comrades. The practical knowledge gained in this way will enable you to understand and to practise the methods that I shall now explain to you for checking arterial bleeding in the upper limbs.

*Arterial bleeding from wounds of the armpit.*—In this case your only resource is digital compression; and you can apply this in two ways:—either by boldly pushing your fingers into the wound and jamming the injured artery tightly against the upper part of the armbone, or by pressing strongly with your thumb or fingers down behind the collar-bone (about its middle), so as to squeeze the artery against the first rib (Fig. 21). In this way you put pressure on to the artery above and away from the wound, on the side of the wound nearest the heart. It is often recommended that a door-key wrapped up and padded should be used to press the vessel behind the collar-bone; but when an accident happens you have no time to run about looking for a key, and still less time for wrapping it up and padding it. You have always got your hands with you, and, if you are to give any help in a case of this sort, you must use them immediately and determinedly, forcing the artery with your thumb or fingers tightly down against the first rib. Practise this when you meet amongst yourselves; you will always know if you are pressing the artery effectually as the pulse at the wrist will then stop.

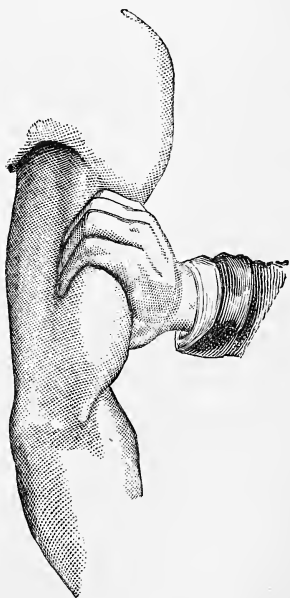


FIG. 22.—Digital Compression of the Brachial Artery.

*Arterial bleeding from wounds of the arm.*—There are several plans by which you can check arterial bleeding from wounds of the upper arm and elbow, but they are

really only different ways of doing the same thing—that is, applying pressure to the main artery on the side of the wound nearest the heart. The readiest method, and the one you should adopt in an emergency, is digital compression; and you do this by grasping the arm in the manner shown in the diagram (Fig. 22), so as to squeeze the artery tightly with your fingers against the arm-bone. You can stop the bleeding in this way *at once*, and then you have a little time to think what you had better do next. If a doctor is close at hand you can of course hold on to the patient's arm until the injury is attended to; but otherwise you must use some additional means to maintain pressure on the wounded artery until professional help is procured. You have received from the Ambulance Association a flat elastic band to which a small piece of tape is attached. This goes by the name of *Esmarch's elastic tourniquet*. It is an appliance, invented by Professor Esmarch, for checking bleeding by pressure on the blood-vessels.\* To fix it on the arm all you have to do is to stretch it well out and then bind it tightly round and round the arm above the wound, taking care that each fold corresponds exactly with the one underneath it, and finally tying the tape over it to prevent it unlapping. If this is put on properly no bleeding can take place, and the patient can be safely carried to his home or the hospital. But you may not have this useful little elastic band with you when it is most needed, and then you will have to improvise a tourniquet, or, in other words, make one out of whatever materials are most convenient and handy. Esmarch recommends that braces and soldiers' belts should be made always of some elastic material, so that they may be used as tourniquets in case of need.† This suggestion seems a good one, more particularly in connection with military service, as it is calculated that one-fifth of those who die on the battlefield lose their lives from bleeding.‡ The chief advantage of having elastic bands, tubing, or cord available

\* Several different tourniquets, varying much in shape and construction, are used by surgeons; but all these instruments are simply mechanical contrivances for the arrest of bleeding by pressure which can be regulated—that is, increased or diminished—as occasion requires.

† Tourniquet braces, invented by Esmarch, were exhibited at the Health Exhibition, and are now supplied by the Ambulance Association, together with a sheet of diagrams and instructions illustrating their use.

‡ *Manual of Instruction for Attendants on Sick and Wounded in War*, Staff-Assistant-Surgeon A. Moffit.

is that it does not require any knowledge of the position of the arteries to enable you to fix such appliances on the limb, all you have to do being to wind your indiarubber band or cord several times tightly around the arm or leg *above* the wound.

But there are other ways of improvising a tourniquet. You can make a very good one by means of a *pad*, a *triangular bandage* or *pocket-handkerchief*, and a *stick*. Place the pad over the artery, and fix it by winding the handkerchief (folded narrow) around the limb and tying it on the opposite side—not tightly, but sufficiently slack to allow of the stick being pushed under it. Thrusting the stick under the handkerchief, twist it vigorously round; the handkerchief of course tightens, and the artery is jammed between the pad and the arm-bone (Fig. 23).\* You can practise making this

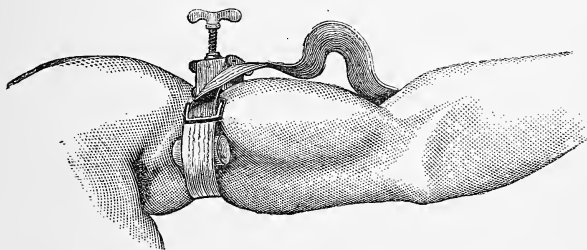


FIG. 23.—Compression of the Brachial Artery by a Tourniquet.

\* In this figure the artery is compressed by means of an ordinary surgical tourniquet; but an improvised tourniquet—as shown in Fig. 26—acts exactly in the same manner.

kind of tourniquet with your folded triangular bandage, a roller bandage for a pad, and your walking-stick or an office ruler. But you must not expect to have these particular articles always about you. You must be prepared to act independently in any emergency, and be quick to utilise any materials, no matter what, so that they are close at hand and suitable to your requirements. Thus you may make a pad of a wine-cork or a bung, a smooth stone, a billiard, bagatelle or racket ball, a ball of worsted or a reel, a piece of wadding, tow, lint, linen, flannel, or cloth rolled up tightly, or a knot on the bandage around the limb will suffice. Instead of the triangular bandage a handkerchief or scarf, a belt, brace, or strap of any kind would do. On a battle-field

there are always plenty of straps, belts, and pieces of accoutrements, etc., suitable for the purpose. To tighten your tourniquet you could use on the battlefield bayonets, scabbards, rifle-cleaners, and fragments of lances, etc.; while in civilian life there are usually available such articles as sticks, parasols, umbrellas, pencils, wooden measures, knife-handles,

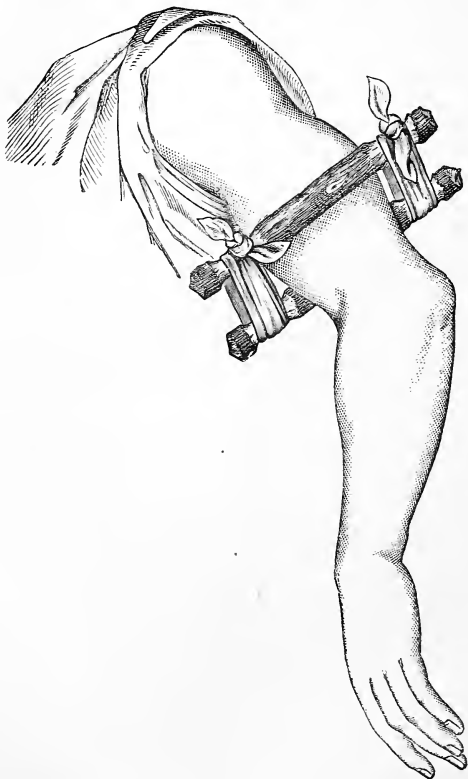


FIG. 24.—Compression of the brachial artery by Völker's stick tourniquet.

large keys, rulers, pieces of wood, or branches of trees. The police could use their truncheons, cricketers their wickets, billiard-players their cues, and tennis-players their racket handles. Should you be unable in a case of emergency to

improvise a pad, you must not lose time, but at once tie your scarf or handkerchief round the arm, and twist it tighter and tighter with your stick until the bleeding is stopped. You may improvise a tourniquet in another way, viz., by taking two pieces of stick about eight inches long, and placing one across the inside and the other across the outside of the arm, and tying them tightly together by a couple of handkerchiefs or straps (Fig. 24). By this plan the artery is compressed between the inside stick and the arm-bone. This arrangement goes by the name of *Völker's stick tourniquet*. The same result is attained by placing one stout stick between the chest and arm and binding the latter tightly to the side.

Now you must practise the application of digital compression and the making of improvised tourniquets frequently amongst yourselves ; but, should an accident happen, do not let the injured man die from loss of blood while you are hunting about for an Esmarch's tourniquet, or feeling in your pockets for a handkerchief. Remember that whatever else may be missing you always have your hands, and act at once by flattening the artery against the arm-bone (at the *upper* and *inner* part of the arm) with your fingers, and then having arrested the bleeding, think how you may best improvise a tourniquet.

*Arterial bleeding from wounds of the fore-arm.*—You can stop arterial bleeding in the fore-arm by arresting the current of blood in the main artery higher up. You may either apply digital compression, an Esmarch's elastic band, or an improvised tourniquet to the upper arm, in the manner I have already explained ; or you may forcibly bend the patient's elbow, tying the fore-arm tightly with a handkerchief, triangular bandage, scarf, or anything else suitable to the upper arm. In this way the artery is so much bent that the current of blood is arrested. If there is anything handy with which you can make a pad, fix it in the hollow of the elbow before you bend the arm, and then you will have, as an additional safeguard, pressure on the artery as it lies in front of the lower end of the arm-bone. Should one of the arteries of the fore-arm be injured where it comes close to the surface just above the wrist, you can apply strong digital compression to the wound itself, or fix a pad and bandage tightly on. Not so long ago a man's wrist was laid open by the bursting of a steam guage ; many in this room must recollect the case, and must also remember how well and effectually a comrade

checked the violent bleeding by twisting and tying a knotted handkerchief tightly round the wrist, arranging it so that the knot acted as a firm pad, pressing strongly on the wounded artery, and squeezing it against the hard bone underneath. But if you have any difficulty in a case of this description, remember you can always arrest the bleeding at once by pressure on the main artery in the upper arm, or by placing a pad in front of the elbow and forcibly bending the fore-arm against the arm.

*Arterial bleeding from wounds of the palm of the hand.*—You can check arterial bleeding from wounds of the palm of the hand either (a) by direct pressure on the injured vessel at the seat of injury, or (b) by arresting the arterial current higher up in the arm. (a) The readiest method is digital compression, and the best way to apply this is to press firmly down on the bleeding point with your thumb. If professional aid is at hand this will be sufficient; but if the patient has to be taken some distance to his medical attendant, then you must apply pressure to the wounded vessel by a good strong pad placed on the palm. The pad should be made of a conical shape, the point of the cone to be thrust into the wound right down on to the injured artery. Pads should, when possible, always be arranged in this form when applied directly to a wound for the purpose of arresting arterial bleeding, as they are much more effective than an ordinary-shaped flat pad. I have already told you how to make a conical pad, or, as it is sometimes called, a *graduated compress*, when speaking of arterial bleeding in cases of scalp wounds. To keep the pad firmly in its place, you double the fingers over it, and tie them tightly down by bandaging round the closed hand with your handkerchief, triangular bandage, or scarf. You will find this plan of applying direct pressure to the wounded artery suitable in most cases of arterial bleeding from the palm; but if the injury to the hand is extensive, then you can easily arrest the arterial circulation higher up—just above the wrist, at the elbow, or at the upper arm. (b) You can apply digital compression above the wrist to the two arteries of the fore-arm where they run close to the surface just before they enter the hand: and you do this by tightly squeezing the vessels with your thumbs against the bones of the fore-arm, but to act effectually you will have to press very hard and perseveringly, and the probability is that your hands will soon get wearied. If you can manage it, therefore, it is better to apply

pressure to the two arteries by fixing two firm pads tightly on them by means of a bandage or strap. You will have to use your ingenuity in making suitable pads—very good ones can be made of a cork cut down the middle, or of pieces of a penholder or pencil, placed lengthways. But if you get nervous, or if you bungle over your efforts to stop the bleeding by pressure at the seat of injury and at the wrist, never forget that you can at once control bleeding in the hand, as well as in the fore-arm, by either forcibly bending the elbow, or by compressing the artery in the upper arm with your fingers or a tourniquet.

There is one very important point to which I have not yet alluded in connection with the rendering of first aid in cases of arterial bleeding from wounds of the upper limb. I mean the *position* of the limb. Always keep it *raised*. No matter what else you are doing to staunch the bleeding—whether you are applying digital compression, or pressure by a pad and bandage, or an improvised tourniquet—always remember to keep the arm raised. If the injured man is lying down, keep the arm lifted up yourself, or prop it at a higher level than the body on cushions or folded clothes. If he walks home or to his doctor, see that the arm is slung up well before he starts—don't merely talk about it and leave others to do it, but sling it for him yourself high up so that the fingers of the injured limb are close to his opposite shoulder. If it is required to sling an arm (in a case of bleeding, fracture, or any other injury) and there is no bandage, handkerchief, or scarf available, you may either utilise the patient's clothing or you can make a *pin sling*. Thus, you may turn up the skirt of the coat and pin it in proper position to form a support for the arm; or you may cut up the coat and shirt sleeves and pin them up so as to make a sling;\* or in some instances you may bend the patient's elbow, raise his hand well up, and pin the coat sleeve *at the wrist* firmly to the coat, fixing as well a fold of the sleeve *under the elbow* tightly to the coat in the same way—additional security being attained by the use of a third pin to fix the *inside of the arm* sleeve to the body of the coat.† In these kinds of improvised slings it is of course much better to use safety pins when they are available in preference to ordinary pins. If the patient is carried off on a stretcher it is the business of one of the bearers (as

\* *The Treatment of Wounded in War*, Esmarch, translated by Clutton.

† "A pin sling," Sampson Gamgee, *Lancet*, September 22, 1884.

I shall explain in the final lecture) to specially attend to the injured limb, and see that it is supported in a proper position.

I now come to the *lower limb*. This is supplied with blood by a large artery which crosses from the trunk of the body over the fore part of the haunch-bone into the thigh (Fig. 6). The artery enters the thigh at the centre of the fold of the groin, and for the first three or four inches runs near the surface and can easily be felt pulsating; it courses downwards and inwards, finally passing backwards on the inner side of the thigh-bone towards the ham.\* The position of the artery



FIG. 25.—Digital Compression of the Femoral Artery.

is shown when the knee is partly bent and the thigh twisted a little outwards, by a line drawn from the middle of the fold of the groin to the inner side of the knee. Reaching the back of the thigh about its lower third, the artery runs down the middle of the ham at the back of the knee-joint, and a little below the joint it divides into two branches. One of these runs down the fore part of the leg, but is deeply placed until it gets near the ankle, when it comes close to the surface and can be felt beating as it courses along the front of the instep towards the back of the foot. The other branch descends the back part of the leg, and it also is deeply placed at first, but as it approaches the ankle it comes near to the surface, and can be felt pulsating as it passes behind the inner ankle to the sole of the foot. Both these arteries terminate in smaller branches that go to supply the different parts of the foot.

You see that the plan of the arterial circulation in the two limbs is somewhat similar. The blood is conveyed to both

\* The part of the lower limb behind the knee, between the thigh and leg, is termed the *ham*.



arm and leg by means of one large main artery which courses along, in both cases, the entire upper part of the limb, dividing—below the elbow-joint in the arm, below the knee-joint in the leg—into two branches. These branches in both limbs are more or less deeply seated in the first part of their course, but come close to the surface as they approach the wrist and ankle joints respectively. In the palm of the hand there are two arterial curves or arches: in the sole of the foot there is one arterial arch. Again, the methods of checking arterial bleeding in the lower limb are very similar to those I have acquainted you with for stopping hæmorrhage in the upper limb. Your resources are the same, viz., digital compression, Esmarch's tourniquet, improvised tourniquets, and the pad (graduated compress) and bandage. The application of them only is different.

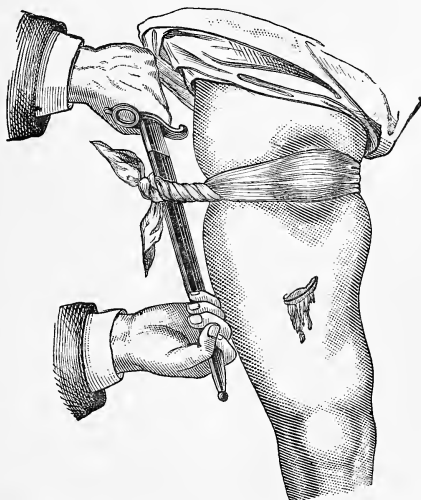


FIG. 26.—Compression of Femoral Artery by an Improvised Tourniquet.

*Arterial bleeding from wounds of the thigh.*—Strong and immediate pressure must be applied to the main artery above the wound in case of arterial bleeding from the thigh. To give effectual aid you must act at once, and with great determination. If you lose your head and hesitate, the patient will be dead from loss of blood before you have decided what

to do. In a case of this kind you must resort immediately to digital compression, and the way to do this is to press with your two thumbs as forcibly as you possibly can (in the manner shown in the diagram, Fig. 25) down on the artery at the centre of the fold of the groin. In this way you compress the vessel against the fore part of the large ring of bone called the pelvis; and this is the best and safest place to use digital compression. If the wound is not too high up to allow of it, you can, it is true, compress the artery with your thumbs against the thigh-bone for three or four inches lower down (that is, in the upper and inner part of the thigh), where the vessel lies near the surface; but you are not so sure of your grip in this position, more especially if the patient is stout. But whether you apply digital compression at the centre of the fold of the groin (flattening the artery against the fore part of the pelvis) or in the upper and inner part of the thigh (flattening the vessel against the thigh-bone), your hand will soon get tired—such is the force and persistency with which you have to press. While you hold on, then, one of your comrades must get your Esmarch's elastic tourniquet, or, if that is not available, he must improvise one, in the way that I have already explained, and fix it tightly on the upper part of the thigh above the wound, taking care that the pad is placed correctly over the artery (Fig. 26). By means of a tourniquet you can bring enormous pressure to bear on the injured artery, and can easily arrest the bleeding until the arrival of professional aid.

*Arterial bleeding from wounds of the ham.*—In this case, you can either apply pressure to the artery of the ham above the wound by means of a tourniquet, or you can arrest the arterial current higher up (and this is the readiest way) by digital compression of the main vessel at the centre of the fold of the groin or in the upper third of the thigh, and then with the aid of a comrade apply a tourniquet.

*Arterial bleeding from wounds of the leg.*—Here, again, you can stop arterial bleeding from wounds of the leg by compression of the artery of the ham or the artery of the thigh, or—just as you can check bleeding in the fore-arm by forcibly bending the elbow—you can arrest the hæmorrhage by forcibly bending the knee and tying the leg tightly to the thigh. “This treatment,” writes Esmarch, “can be successfully practised in cases where other means of ar-

resting hæmorrhage are not at hand. It is, however, to be observed that a position sufficiently flexed to completely arrest hæmorrhage cannot be long tolerated."\* In this way the artery of the ham is bent at such a sharp angle that the flow of blood through it is stopped. You can apply compression to the vessel as well by placing a pad in the hollow of the ham before you bend the knee. The artery of the front of the leg is liable to be injured at the lower part of its course where it comes near the surface, as it runs down in front of the lower portion of the large leg-bone over the ankle-joint to the top of the foot; but the bleeding can be easily stopped by pressure on the vessel above the wound. Use digital compression to stop the bleeding until you can get a good pad fixed tightly on.

*Arterial bleeding from wounds of the sole of the foot.*—To check arterial bleeding from wounds of the sole of the foot you can—as in hæmorrhage from the palm of the hand—either apply (a) direct pressure at the seat of injury, or (b) arrest the arterial current higher up. (a) If you try the first method thrust your thumb down into the wound right on to the spouting blood-vessel,† and then with the assistance of a comrade proceed to apply a good firm graduated cone-shaped pad tightly on with a handkerchief, scarf, or strap of some kind. (b) If you try the second method (and should the wound be an extensive one and the bleeding profuse, it is the best) apply firm pressure to the artery which supplies the sole of the foot where it lies near the surface *behind the inner ankle*. Examine your own lower limbs and you will easily feel the artery pulsating in this position, and you will also notice that it can be easily compressed with the fingers or by a pad fixed on with a handkerchief. If after fixing on your pad there is still some bleeding, place a second pad in *front* of the ankle, and a third *behind the outer ankle*, and bind all three pads tightly on with your handkerchief, scarf, or a strap. The purpose of the two additional pads is to compress the

\* *The Treatment of Wounded in War*, Esmarch, translated by Clutton.

† Several military surgeons think that, on the battlefield, the best plan for the bearers, attendants, and troops to adopt for the arrest of bleeding—from any part of the body—is to thrust their fingers into the wound and press directly on to the injured vessel. The Russians in the Crimean War, and the Austrians in the campaign of 1859, adopted this plan with success. It is on record that a young Austrian soldier arrested the bleeding from an injured femoral artery (*of his own left thigh*) for four hours by forcibly thrusting his left thumb into the wound, and so preserved his own life until treated by the surgeon.—*Gunshot Injuries*, Surgeon-General Longmore.

artery supplying the back of the foot and a small artery that lies behind the outer ankle, because both these communicate with the arterial branches of the sole. If you put on your pads properly the bleeding must cease, as the supply of arterial blood to the foot is quite cut off; but always remember that if you are in any difficulty you can at once arrest bleeding in the lower parts of the limb by compression of the artery of the ham or artery of the thigh.

Lastly, in all cases of arterial bleeding from wounds of the leg, as in all similar injuries of the arm, always be very careful to see to the *position* of the limb. Always keep it *raised*. If the injured man is lying down or being carried on a stretcher, the limb must be lifted up or propped up on cushions, pillows, folded clothes, or anything else suitable, at a higher level than the body. In *all* cases of arterial bleeding from the lower limb, place the injured man *at once*, when you can, in the lying-down position, and if possible, have the limb elevated while you apply compression above the wound.

I think I have now told you all that is most important in connection with arterial bleeding. It remains for you to practise the application of improvised tourniquets, digital compression, etc., amongst yourselves; and I hope you will seize frequent opportunities of examining yourselves and each other, and trying to feel the beating of the different arteries in those positions where they run near to the surface, and where they can be compressed, for it is by such kind of practice that you will acquire practical knowledge. When practising digital compression, and the application of Esmarch's elastic band and improvised tourniquets to the larger arteries, you should always test your work by feeling for the pulsation of smaller vessels lower down in the limb—such as the arterial branches near the wrist and ankle joints. If the pressure you apply to the main arteries is effective, all pulsation lower down the limb ceases; on the other hand, if the pulsation continues, you are either applying insufficient pressure or you are applying it at the wrong spot.

#### CAPILLARY BLEEDING OR HÆMORRHAGE.

The bright red blood is pumped by the action of the heart through the arteries into the capillaries, and it is during its passage through these little delicate tubes that the blood

gives up the nourishment it contains to the surrounding tissues. To be healthy, all the different parts of the body must perpetually receive sustenance from the blood, and this is ensured by all the tissues and organs being pervaded throughout by a complete network of the small capillary tubes. You can understand, therefore, that when any part of the body is wounded, numbers of the capillaries are necessarily broken, and there is a leakage of blood from them, or, as it is termed, capillary bleeding or hæmorrhage. In *all* wounds there is capillary bleeding, and should an artery or vein be injured, it is accompanied of course by arterial or venous bleeding, as the case may be. But in many wounds, particularly in slight ones, as scratches, abrasions, trivial cuts, etc., and also in ordinary flesh wounds, there is only capillary bleeding. This kind of bleeding is trivial, compared with arterial and venous bleeding. In cuts from sharp substances, as bits of glass, razors, &c., and in extensive flesh wounds, the bright red blood may flow off pretty sharply, but there is no spouting from an opened artery, nor any dark stream pouring continuously down from an injured vein, but simply oozing—rapid it may be, for a short time—from the entire raw surface of the wound. Capillary bleeding is easily stopped by *pressure* applied to the *whole of the bleeding surface*—pressure with your finger or thumb; by means of a soft piece of linen, lint, or any clean wrag wrapped around the part; by the application of a pad and bandage; or by a piece of ordinary sticking-plaster strapped tightly across the wound; in short, by any simple, clean, temporary “first dressing.” *Cold* is another remedy. It can be used by washing with cold water, exposing the wound to the cool air, or by the application of ice. You can combine pressure with cold by fixing on a pad that has been soaked in cold water. *Styptics*, such as alum, steel drops, powdered galls, and tannin, cause clotting of blood, and are occasionally useful for checking troublesome oozing.

#### VENOUS BLEEDING OR HÆMORRHAGE.

The different tissues of the body not only receive nourishment from the blood during its passage through the capillaries, but also give up to it certain hurtful and useless materials which they must necessarily be rid of, and so the

blood is rendered impure, and as it flows on from the capillaries into the veins becomes of a dark purple or blackish colour. The dark impure blood is carried from all parts of the body by the veins back to the heart, the direction of the blood current being exactly opposite to that in the arteries. The veins vary a good deal in position, some lying deep under the flesh, and others being quite close to the surface and often visible through the skin as dark blue lines or cords. It is these superficial veins that are more liable to injury. In thin people you can easily see them, particularly after exertion, on the back of the hand, the front of the fore-arm and elbow, the top of the foot, the back and sides of the leg, and often in the neck.

The veins of the neck are sometimes cut in suicidal attempts, those of the arm may be injured by the slipping of a knife, and those of the leg by the careless use of a scythe. A more frequent occurrence is the rupture or bursting of one of the veins of the leg as a result of disease. This is an occurrence which it is by no means unlikely that you will meet with, and it is precisely one of those cases where you can give the most valuable assistance, even to the extent of saving life.

Many persons, especially women, suffer from an enlarged and diseased condition of the veins of the leg. The veins are seen to be swollen, knotted in appearance, and gorged with dark blood; and there is frequently, as a result of this state of the veins, dark red discoloration, swelling, and, it may be, ulceration of the limb. These people are suffering from *varicose veins* of the leg, and it is not at all an uncommon occurrence for one of these swollen diseased veins to give way with profuse—sometimes fatal—bleeding as the result. A pint or more of dark venous blood may be in this way lost in a few seconds; and yet, if you only know how, you can immediately stop the bleeding with the greatest possible ease.

To arrest the bleeding from an injured vein you must—as in the other varieties of bleeding—resort to *pressure*, but in this case the pressure must be applied to the wounded vessel on the side of the wound *farthest from the heart*—that is in the limbs, *below the wound*. The readiest plan is to press your finger or thumb, whichever happens to be most convenient, on to the hole in the vein, and you can easily stop the bleeding in that way until you have time to make a pad and fix it

firmly on to the wound by means of a triangular bandage, handkerchief, or scarf. If the wound is large and gaping, then of course you must apply pressure to the injured vein, on the side of the wound farthest from the heart.

There is a point of importance in connection with bleeding from a ruptured varicose vein of the leg that I must explain to you. You are aware that veins, unlike arteries, are provided with valves, and these valves when they are in working order allow the blood in the veins to flow in its proper direction to the heart, but arrest it at once if, from certain movements or positions of the body, it tends to flow the opposite way *from* the heart. Thus it is that when a vein is cut the dark blood only wells up from the cut end farthest from the heart, escape of blood from the cut end nearest to the heart, being prevented by the valves (that is, with the exception of the small quantity of blood in the vein between the cut end and the nearest valve). Now veins that have become diseased and varicose are unnaturally and permanently enlarged, stretched, and swollen, and consequently the valves in them are rendered useless, so that if a varicose vein of the leg is accidentally cut across, bleeding not only occurs from the cut end farthest from the heart, but also is profuse from the cut end nearest to the heart, the blood rushing copiously down through the wound direct from the trunk. This is the reason why, in a rupture or injury of a varicose vein of the leg, the bleeding is so profuse and dangerous; it also explains why, in order to stop the bleeding, it is necessary to apply pressure on *both sides* of the opening in the vein. If a varicose vein gives way, or if the wound is small, then by pressing on the bleeding point with your thumb or finger, or by means of a pad, you do actually apply pressure on both sides of the opening in the vein; but if the wound is large and gaping, and particularly if it is vertical in direction, slitting the vein up, then you must be very careful to apply pressure both above and below the wound.

Next to *pressure*, your chief resource in venous—as in other severe bleeding—is *position*. Always keep the wounded limb *raised*. In the case of a varicose vein of the leg bursting you can at once arrest the bleeding by pressing with your finger on the hole in the vein, at the same time placing the patient in a lying down position with the leg well raised.

Lastly, always be careful to remove any article of clothing that is at all tight and worn anywhere on the side of the

wound next the heart, as any constriction in such a position interferes with the flow of blood through the veins, and tends to increase the bleeding. Thus in the case of a ruptured varicose vein always remove the garter; in venous bleeding from the neck loosen the collar and necktie; and in other cases loosen the braces, belt, waistband of trousers, etc., according to the position of the wound.

### INTERNAL BLEEDING OR HÆMORRHAGE.

Bleeding, when the blood escapes directly outside the body, is called *external*; and I have shown you how by the proper application of *pressure*, due attention to *position*, the use of *cold*, and occasionally of *styptics*, you may generally give most valuable assistance in cases of external bleeding. Bleeding is called *internal* when it occurs inside the body. The blood-vessels inside the head, chest, and belly may be ruptured either from disease or injury, the blood escaping into one of the cavities, organs, or passages, of the body. Thus, as a result of disease, blood-vessels may give way in the brain, the lungs, and the stomach; and any of the deeply-placed blood-vessels may be opened by such injuries as bullet wounds and stabs. Internal bleeding is sometimes the result of a bone being broken; for instance, bleeding inside the head may be caused by a broken skull, or bleeding inside the chest by a broken rib. In many cases of internal bleeding you never see any blood at all; in other instances the blood escapes from the body in one way or another; thus the patient may cough up blood if there is bleeding in the lungs, or vomit blood if a blood-vessel in the stomach has ruptured.

You cannot give so much assistance in cases of internal as in external bleeding, because you cannot get at the wounded vessel to apply pressure to it. But you can attend to the *position* of the patient, and resort to *cold*, and you can give him astringent drinks. You should place the patient in a comfortable lying down position, with the head slightly raised, and, above all things, let him rest as quietly as possible. Do not allow bystanders to worry and excite him with talk. Keep people from crowding around him, and if in a room open the window so that there shall be plenty of cool fresh air. If there is any spitting or vomiting of blood get ice if possible, and give small pieces of it to suck. If ice is not available



give small quantities of cold water or vinegar and water for the patient to drink, and apply cloths steeped in cold water, or ice in a bladder, to the chest, or as near as possible over the spot where bleeding is going on. Lastly, you can give the patient astringent drinks, such as alum and water, or cold strong tea (which contains tannin). Of course all tight clothing should be removed.

*Bleeding from the nose* is occasionally very severe and troublesome, whether it be the result of accident or disease. To check it, keep the patient's head raised, *not hanging forward*, and apply cold—in the shape of ice, iced water, or sponges, cloths, or handkerchiefs steeped in cold water—to the root of the nose and to the back of the neck. If the bleeding is obstinate make the patient stand up, then suddenly lift his arms straight above his head, and keep them up for a few minutes. If he only lifts one arm up it should be the one on the same side as the bleeding nostril, and with the disengaged hand he should squeeze the nostril. Dr. Negrier of France and others have used this plan with the greatest success, and it has also been successfully adopted in cases occurring among the men of the 104th Regiment.\* If you happen to have a syringe, you can syringe the bleeding nostril with cold water, or alum and water; but the application of cold, and the plan of raising the arms, is usually sufficient.

For *bleeding from the tongue* wash the mouth out well with cold water, or alum and water. If ice is available small pieces should be sucked. The collar and all other parts of the clothing about the neck should be loosened. The patient should breathe through the mouth, and he should be placed so as to get the benefit of as much cool fresh air as possible.

\* *Diseases of the Nose*, W. Spencer Watson.

## LECTURE III.

## BROKEN BONES OR FRACTURES.

The methods of rendering first aid in such accidents—The application of splints and bandages—The signs of fracture—The difference between fractures and dislocations—First aid in cases of sprains and contusions.

WHEN a bone is broken it is said to be *fractured*. Any of the bones of the skeleton may be injured in this way. Sometimes a fracture is caused by direct violence, such as a kick from a horse, or a fall of rock, the bone being broken at the seat of injury. In other instances a fracture is caused by indirect violence, as when a man jumps from a great height and has his legs broken, and this though he alights on his feet. Similarly many a collar-bone has been broken by heavy falls on the shoulder, elbow, or outstretched hand. More rarely a bone is fractured by violent action of the muscles. The most familiar example of this is fracture of the knee-cap by a desperate effort to recover oneself after slipping. When a bone is fractured by very great violence, as in gunshot wounds, railway accidents, etc., the flesh at the seat of injury is often torn and lacerated, so that there is a wound right down to the broken ends of the bone. Such a fracture is said to be *compound*. When a bone is broken, and there is no accompanying injury to the flesh or any other of the neighbouring parts, then the fracture is a *simple* one. Now a simple feature can be made into a compound one very easily by the struggling and efforts to rise of the patient himself, or by the rough and careless handling of the injured part by the bystanders. If the patient struggles or attempts to move himself, or if others try to carry him away from the scene of the accident without the injured limb being properly supported, the broken ends of the bone are liable to be pushed through the skin, making the fracture a compound one. Such a mishap is most serious, for it not only adds to the pain and suffering of the patient, but it, at the best, delays his recovery, and too often either his limb or his life is sacrificed. Even if—in spite of incautious movements of the

patient, or careless handling of him by his helpers—the broken ends of the injured bone do not actually penetrate through the skin, they may nevertheless tear open a large blood-vessel, wound an important nerve, or injure one of the chief internal organs, such as the brain, the lungs, or the bladder—thereby forming a *complicated* fracture. It is a well-known fact that many a limb, and, alas, many a life, has been lost by the unskilful, careless, or rough handling of well-meaning but ignorant friends, who in their attempts to give help in cases of fracture have forced the broken ends of the bone either through the flesh and skin, into some large blood-vessel, or into some other important neighbouring structure. When any of the bones of the trunk are fractured, one or other of the important internal organs are often injured, or if these escape at the time of the accident they will certainly be torn or crushed by the broken edge of the fractured bone, should any carelessness or unskilful handling be displayed in carrying the patient from the scene of the accident. Thus great care must be taken in the transport of a man who has had two or three ribs fractured, or the rough jagged ends of the broken bones will be pressed against the lungs.

Now comes the question, How can you give help in cases of fractured bones? You can render most valuable assistance by supporting the injured part so as to prevent the fragments of the broken bone from moving about and tearing the surrounding tissues. By so doing, in all instances you can relieve pain; in the case of an injured limb you can prevent a simple from becoming a compound fracture, or the jagged end of the bone from wounding some important blood-vessel or nerve; in the case of an injury to one of the large cavities of the trunk, such as the chest or pelvis, you can hinder the rough edge of the broken bone from penetrating some important internal organ, and even if there is some internal injury resulting from the accident, you can at least prevent further mischief during the conveyance of the patient to his home or the hospital.

In fractured limbs you can best support and fix steadily the broken fragments of the bones by means of splints and bandages, and you should apply these, if possible, *before the patient is moved*. It may be necessary, however, to get the injured man away from the place where he was hurt immediately; for example, he may be in a position of great danger,

and you have no time to provide or apply splints before removing him to a place of safety. Frequently too, especially in coal-pits and other large works, accidents happen in spots where, from overcrowding, want of room, and bad light, it is practically impossible either to examine the patient or to apply splints until he is removed, at all events, a short distance. It is very important, therefore, that you should know how to hold a fractured limb so as to properly support it during the removal of the patient. A person cannot well apply splints single-handed, so it is equally desirable that you should be able to grasp and steadily raise a fractured limb while a comrade binds on the splints. Now, in handling a fractured limb—whether you have charge of it during the removal of a patient, or are assisting to apply splints—you must hold it firmly and fixedly in as natural a position as possible, taking particular care that there is no bending of the limb at the point where the bone is broken; and to accomplish your object you should place one hand underneath the limb above the fracture, the other underneath the limb below the fracture, and grasp the limb with sufficient firmness to prevent it slipping or rolling. In this way the limb rests upon, and is well supported by, the palms of the hands, and can be held safely in position without risk of the fragments of the bone being displaced until splints and bandages are put on.

You have received from the Ambulance Association several wooden splints, some of which are provided with a metal socket at one end. These are for use in cases of fractured limbs; and you are able by means of the sockets to fit two or three splints together, so as to form, if you require it, one long support—such as would be needed, for example, in the case of a fractured thigh. These splints would be very useful to you in an emergency if they were close at hand, and they are invaluable for practising with amongst yourselves. But you never know where you may be, or under what circumstances you may be placed, when an accident occurs; and most probably it will happen that, when you most require them, these ready-made splints will not be available. You must always be prepared therefore in an emergency to make temporary splints out of any suitable materials that chance to be near. Thus for this purpose you can use cardboard, the backs of books, folded or rolled up newspapers, leather, gutta-percha, pieces of wood (Fig. 31), trellis flower-pot covers, cigar boxes, sticks of all kinds, parasols and umbrellas, broom-

sticks, policemen's truncheons, laths, spokes of wheels, wickets, paling, the bark of trees, mats, baskets, rolls of straw, heather, brushwood, rushes, and small branches; and on the battlefield, lances, bayonets (Fig. 33), scabbards (Fig. 32), rifles (Fig. 29), and carbines. Straw mats were used by the French at the last siege of Paris as splints. Telegraph wire and wire gauze are utilized by military surgeons for the same purpose. Bundles or rolls of straw tied together make very good splints; "a pair of these are rolled in the opposite borders of a cloth, the intervening portion of which is placed beneath the wounded limb; the bundles are thus adjusted, one on each side of the limb, and can be fastened there with cord" (Fig. 30).\* A similar arrangement can be made with straw bottle-casings, and a handkerchief, napkin, or triangular bandage. In the same manner a coat may be slipped under a fractured limb, and the borders rolled up to it on each side, the whole being secured by handkerchiefs, scarfs, or straps. When splints are made of wood or other hard material it is necessary to place some sort of soft padding between them and the injured limb, such as cotton, wool (Fig. 28), wadding, hay, moss, horse-hair, dried sea-weed, lint, linen, flannel, or parts of the clothing (Figs. 29, 32 and 33). You can bind the splints on to the fractured limb by triangular bandages, pocket-handkerchiefs, napkins, neck-handkerchiefs, scarfs, garters, braces, tape, cord, belts, and straps of all kinds. In fractures of some bones—as the lower jaw, for instance—the application of a bandage is sufficient to give the necessary support to the broken fragments until medical aid is procured (Fig. 27), while in other cases, as fracture of the back-bone, all your efforts must be directed to the conveyance of the patient—gently, carefully, and without altering the position of his body—on a stretcher either to his home or to the nearest hospital.

Having explained to you in a general way how you can render valuable first aid in cases of broken bones, I will now refer more in detail to the different fractures which you are likely to meet with, and endeavour to point out how you may best give assistance in each case. I will begin with fractures of the face and trunk.

The *lower jaw* is not unfrequently broken by direct violence, such as a kick from a horse, a blow from a man's

\* *The Treatment of Wounded in War*, Esmarch, translated by Clutton.

fist, or a heavy fall. You can easily recognise this: the man cannot use his jaw, the gums are torn and bleeding, and usually one or more teeth are loosened. The line of the teeth and the under margin of the jaw are irregular; and on examining the injured part you can easily feel the broken fragments of bone rubbing one against the other. This rubbing or grating together of the rough edges or ends of the fragments of a broken bone is in any part of the body a sure sign of fracture, and is called *crepitus*; it can be felt by placing the hand on the seat of fracture (and in many instances heard as well) during movement of the injured part. The patient often distinctly feels the bone give way at the time of the accident, and, finding that he has lost power over the jaw, frequently tries to support it with his hands. You can give great relief in an accident of this kind by placing the broad part of a folded triangular bandage or handkerchief underneath the injured jaw, carrying the ends up and tying them at the top of the head; or if the handkerchief is long enough you may cross the ends at the top of



FIG. 27. — Chin-Sling of Handkerchiefs for a broken lower jaw.

the head, bring them down again, and tie under the chin. In this way the broken jaw will be well supported, but you can fix it more securely still by placing the centre of another handkerchief—should you be fortunate enough to have one—on the front of the chin, and carrying the ends backwards tie them behind the neck (Fig. 27).

*Fractures of the skull, spine, and pelvis* are usually associated with injuries of very important internal organs, and are therefore of an extremely dangerous nature. In fracture of the skull the brain suffers; in fracture of the spine the spinal cord is injured; and in fractured pelvis the bladder and other vital parts are endangered. If symptoms of serious brain mischief follow after an accident, such as a heavy fall or blow on the head, then you may reasonably suspect fracture of the skull,\* even though there is no appearance of

\* The brain, however, is not always injured in fractures of the skull, so that this accident may be followed only by symptoms of stunning, or indeed for a time by no symptoms at all. But if symptoms of serious injury to the brain follow a blow or fall on the head—whether there is any wound of the head or not—then you may reasonably suspect fracture of the skull.

external injury, A fragment of bone may be driven inwards on to the brain, or a blood-vessel may be ruptured inside the head, as frequently happens in fractures of the floor of the skull, or, as they are termed, "fractures of the base." In such cases, usually spoken of as *compression* of the brain, the brain is pressed upon by the piece of bone, or by the accumulation of blood from the injured blood-vessel; and the patient lies insensible, more or less completely paralysed, with, it may be, occasional convulsive movements, snoring loudly, the eyes being insensible to the touch, the pupils insensible to light, and one or both of them dilated; and with all this there may be bleeding either from the ear, mouth, or nose, or, more rarely, a copious watery discharge from the ear.

Fracture of the spine is easily recognised on account of the accompanying injury to the spinal cord, and the paralysis of the parts of the body below the seat of the fracture. Many of you, unfortunately, have seen accidents of this description, and well remember the heavy fall of coal or dirt on your comrade's back, the tenderness and pain caused by the blow, and worst of all the loss of feeling in the sufferer's legs and his inability to move them—sure signs, you know as well as I do, of serious injury to the spine.

Fractures of the pelvis are the result of great violence—such as a squeeze between the buffers of two railway trucks. The patient is unable to stand, and any movement or attempt to get up causes great pain and a feeling as if the body was giving way. Sometimes you may be able to feel crepitus. The great danger in these cases is that the bladder or other vital parts may be torn.

Now, in all these serious cases of fracture you should endeavour to convey the sufferer as steadily and as gently as you can to the nearest hospital or to his home, and you must be particularly careful when lifting him on and off the stretcher that you disturb the injured part as little as possible. Medical aid should be sought for at once; but in the meantime the patient should be placed in the lying-down position with the head slightly raised. In fractures of the skull, you can, before the doctor arrives, apply cold to the injured part, especially if there is any bleeding from the ears, nose, or mouth. Ice may be used for this purpose broken into small pieces and tied up in a bladder; or you can apply sponges, cloths, or folded handkerchiefs steeped in cold water. You should be careful also to remove anything tight about

the neck and chest, such as the collar, necktie, and braces. The bedroom, too, should be darkened, and the patient kept as quiet as possible. Above all things, do not attempt to give any brandy or other stimulant, and keep the room clear of talkative, noisy, though it may be sympathetic and well-meaning, friends.

In all these serious injuries to the head and trunk you should make a point of examining the patient's feet, and if they feel cold you should apply hot-water bottles, bladders of hot water, or heated bricks wrapped up in flannel. You must be careful, however, in cases of insensibility from a fractured skull or loss of feeling in the feet and legs from a broken back-bone, not to make your water bottles or bricks too hot, or the feet of the patient may be severely burnt. I allude to this precaution, as not very long ago I met with a case of fractured spine in which this misfortune actually happened.

I wish once more to impress upon you, in all these serious cases, the supreme necessity of exercising the greatest possible gentleness, care, and judgment in the conveyance of the patient from the scene of the accident. The injury resulting from the accident is always very dangerous, but any roughness, careless handling, jolting, or jerking, on your part, will aggravate the existing mischief and render the case positively hopeless.

*Fracture of the ribs* is a rather frequent accident. The patient complains of sharp catching pain at the seat of injury, greatly increased by coughing and deep breathing. He describes the pain as "catching his wind," or "catching his breathing," or he says he "cannot get his wind for it"; and in order to relieve his suffering as much as possible he takes short breaths. This kind of breathing is described as *shallow*. You may feel crepitus if you place your hand over the seat of injury when the patient coughs. Frequently, in these accidents, the lung is penetrated by the broken end of a rib, and there is internal bleeding and spitting of blood. Now, though of course the ribs must continually move in the act of breathing, you can steady and support fractured ribs, and prevent undue and excessive movement of the broken fragments by applying a broad bandage over the seat of injury and carrying it around the chest. A triangular bandage, or a good-sized handkerchief, folded broad, or a scarf, would serve the purpose very well, the broad part being



placed over the seat of injury, and the ends carried around the chest and securely fastened with pins or tied. Firmer and more comfortable support is afforded by binding the chest around tightly with a good flannel bandage about six inches wide. If plenty of sticking-plaster is available, you may apply broad strips, one overlapping the other, right around the side of the chest from the breast-bone to the spine. In this way, by steadying and supporting the injured ribs, and checking undue motion of the broken fragments, very great relief is given to the patient, and the risk of the lung being wounded by the broken ends of the bone is very much lessened. A patient with broken ribs, after being bandaged, should always, when practicable, be removed on a stretcher, the upper part of his body being supported by cushions or folded clothes, so that the chest may be well raised and at the same time slightly inclined towards the injured side.

*Fracture of the collar-bone* is a common accident, frequently being caused by falls on the shoulder and out-stretched arm. In other instances it is broken by direct violence to the bone itself. You can, as a rule, easily see what is the matter. The patient comes to you with his head leaning towards the injured side, and supporting the elbow of his helpless arm with the other hand; the shoulder is much lower down and nearer the breast-bone than is natural. On passing your finger along the collar-bone you at once notice the irregularity caused by the fracture, and can feel the broken end of the inner portion of the bone through the skin, the outer fragment of the bone being depressed. If you raise the shoulder by pushing up the elbow most of the disfigurement is removed, and if you gently twist the arm at the same time that your other hand is placed over the fracture, crepitus is easily felt. There is no difficulty, therefore, in recognising a broken collar-bone, and you can give very valuable assistance to the patient. You must improvise a good pad, and push it right up into the armpit of the injured side at the same time that you raise the shoulder by pressing up the elbow, keeping the latter, however, close to the side. You then put on a large arm-sling, so as to keep the shoulder raised to its proper height; and lastly, you bind the arm to the side with a scarf, folded handkerchief, or triangular bandage. The pad should be firm and of a fair size; it should be about three inches thick at its upper part and taper downwards, so as to be of a

conical or wedge shape. When the pad is pushed well up in the armpit at the same time that the elbow is pressed against the side, the shoulder is thrown outwards into its natural position, and is kept at its proper distance from the breast-bone. The large arm-sling, which should thoroughly support the elbow, keeps the shoulder raised to its proper height.

In *fracture of the arm-bone* the arm is, of course, quite helpless; crepitus can be felt; there is often more or less deformity—or loss of the natural shape—of the arm, which is due to shortening caused by the lower fragment of the arm-bone being drawn upwards by the action of the muscles; and there is mobility at the seat of the fracture—that is to say, the arm can be bent at the place where the bone is broken. To support the injured bone, and keep the broken fragments steady in their place, you should apply three or four padded splints to the arm (Fig. 28). These splints should reach from the shoulder to the elbow; and after they have been securely bound on by means of triangular bandages, handkerchiefs, or straps, a small arm-sling should be put on. It is undesirable to use the large arm-sling in this instance, because on no account must the elbow be pushed up. In the diagram (Fig. 28) you notice that a roller bandage is applied from the hand to the elbow; but, though the fore-arm would be bandaged by the surgeon in his treatment of the case, you—in giving first aid—should at once direct your attention to putting on the splints and slinging the arm; indeed, in an emergency, you would neither have the time nor the means for anything else.

*Fracture of the fore-arm* is rather a common accident, and, as in the case of fracture of the upper arm and I may add fractures of all the long bones of the limbs, you easily know it by the unnatural shape of the injured part, the crepitus, the mobility at the seat of the fracture, and the complete uselessness and helplessness of the limb. You can best support a broken forearm by bending the elbow at a right angle, with the thumb pointing upwards, and applying two splints—one on the inside of the fore-arm from the bend of the elbow to the ends of the fingers, and the other on the outside of the fore-arm from the elbow to the wrist. After you have securely bound on the splints you should further support the fore-arm by putting on a large sling.

For *injuries of the small bones of the hand* you bind on a splint along the front or palm side of the hand, and then put

on a small sling. These fractures are not unfrequently the result of fighting, and can be usually recognised by the pain and swelling of the affected part, and crepitus. To support a broken finger you can easily fix a small cardboard splint along the front of it by means of strips of sticking-plaster, pieces of tape or ribbon, or a strip of your handkerchief; and do not forget to sling the hand. When putting on the small arm-sling in cases of this description it is better to arrange it so that the end which passes in *front* of the hand shall be carried over the *opposite* shoulder, as in this way the hand receives the most support; and if handkerchiefs or scarfs are not available for making a sling, (you may as mentioned in the previous lecture) use either a *pin-sling*, or make the skirt of the coat or the cut sleeves of the coat and shirt serve the required purpose by pinning them up over the injured arm. Men who have sustained fractures of the arm or collar-bone should not be allowed—even when first aid has been rendered to them—to walk home or to the surgery by themselves, as they may become faint or giddy on the way and fall in such a manner as to greatly aggravate (and increase the danger of) their injuries. If in much suffering, the injured man should be carried either in the sitting position or on a stretcher; if on a stretcher, he should be resting on his back or on the sound side, as in such a position there is less chance of the broken limb being disturbed during the conveyance of the patient.

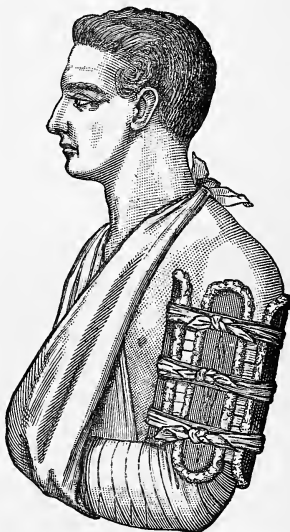


FIG. 28.—Splints for a broken arm.

*Fractures of the thigh* are among the most important injuries for which you may be called upon to give first aid, partly on account of their frequency, but chiefly because of the extreme care, gentleness, and skill required in the conveyance of the sufferer from the scene of the accident to his home or the hospital. These injuries, I have observed, are

in coal-pits frequently caused by heavy falls of coal or dirt from the roof. In some instances the patient feels the bone give way or “snap;” in others, when he is almost buried and much shaken by the fall, he is unaware that his thigh is injured until he attempts to use it, when he finds it powerless. The unnatural appearance of the limb at once shows what has occurred. There is shortening, as the lower end of the broken bone is dragged upwards by the action of the muscles; the thigh is swollen and enlarged as the lower piece of the bone is drawn up on the inner side of the upper piece, and the muscles become thicker during their contraction; and the limb below the seat of the fracture falls or twists outwards so that the foot rests on its outer side, not on the heel. If there is any movement of the limb, either through the struggling of the patient, or rough handling by the bystanders, loud crepitus, or rubbing of the broken ends of the bone against one another, may be *heard*, and should one of your hands be placed over the seat of injury—easily *felt*. Now, I need hardly remind you that in these accidents it is of the greatest importance to the patient, more particularly

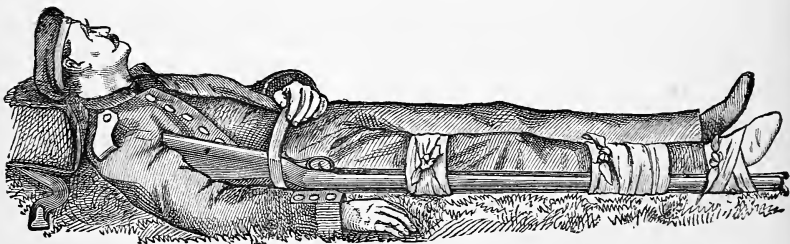


FIG. 29.—Ritle as Splint for a broken thigh.

if he is a working man, that he should not only recover his health and strength, but also have a useful limb. An ordinary case of simple fracture of the thigh can be successfully treated by the surgeon, but it is very different if the artery of thigh or ham is injured by a jagged fragment of the bone, or if one of the broken fragments is driven through the flesh and skin, making the fracture a compound one. In such cases as these the patient is in danger of losing either his limb or his life; indeed, it is not at all unlikely that he may lose both, for—according to one of our most eminent surgeons—amputation for injuries of the thigh-bone itself

is one of the most fatal operations in surgery. You can appreciate, therefore, the grave responsibility that rests upon you when called upon to give help in cases of broken thigh; you must surely see the necessity of acting with all the care, gentleness, coolness, and judgment of which you are possessed, so that you may give up the injured man into the surgeon's hands in the same condition, *not worse*, as when the accident occurred. If you once lose your head, and act hurriedly, roughly, and injudiciously, you will make the injury *worse*; a large blood-vessel will be torn, the flesh lacerated, or the skin actually pierced by a broken end of the bone; and through your carelessness the limb may have to be amputated to give the unfortunate sufferer his only chance—a *small chance*—of life.

If you have splints near at hand, or there are any materials lying about with which you can make temporary splints, you should apply a long one on the outer side of the injured limb from the armpit to the lower part of the foot, and another shorter one on the inner side of the thigh from the top of the thigh to the knee. While you are fixing on these splints a friend should keep the injured limb extended to its natural length by grasping the foot and drawing steadily down until the feet are level, taking care that the foot of the injured side is in its natural position with its heel (not its outer side) next the ground. If you are unable to extemporise a long outside splint, you can apply two splints—one on the outer side, the other on the inner side—from the top of the thigh to the heel, with a third short splint on the front of the thigh. On the battlefield a rifle placed with the butt in the armpit is found to make a first-rate long outside splint (Fig. 29). When you can get them, always apply the splints as soon as possible, and before the patient is moved, taking care to pad them well with hay, straw, portions of the clothing, or anything that is convenient and suitable. As an additional safeguard, you should never omit to *tie the legs together*, as still greater support is thus afforded to the injured limb. Should no splints, nor any materials from which you can improvise some, be near when you are called upon to give help for a broken thigh, you must not be disheartened, but must make the sound leg do duty as a splint. Place a little soft material, such as folded clothing, hay, or straw between the limbs and bind them firmly together with handkerchiefs, scarfs, or straps. It is always best to tie

the limbs together at several places in order to give greater steadiness and security to the injured thigh ; so you should not only bind the feet to each other, but also the knees, and the thighs above the level of the fracture. I have already told you how, at the last siege of Paris, the French used straw matting to wrap around broken limbs. The same material may be used, when available, for a fractured thigh, more especially when it is required to move the patient a con-

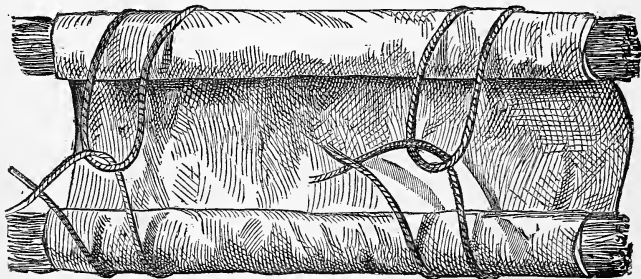


FIG. 30.—Bundles of Straw or Rushes used with a Cloth to support a Broken Limb.

siderable distance. The injured man is laid on the straw mat ; some rolled up clothing, a sand-bag, a bundle of straw, or other suitable padding, is placed between the thighs, and the matting is wrapped around the patient's hips and thighs, and securely bound on by straps or cords.\* When you have supported the injured limb and secured it as firmly and comfortably as possible in its natural position, then it is safe to move the patient from the scene of the accident to his home or the hospital ; and the rule is, in cases of broken thigh or other fractures of the lower limb, to lay the patient on his back, inclining towards the injured side, on the stretcher (as in such a position there is less likelihood of the broken-bone being disturbed during the conveyance of the injured man) ; and the greatest care must be taken in lifting the patient on and off the stretcher. It must be the sole business of one man to attend to, and take charge of, the injured limb ; and certain precautions, which I shall explain to you in the last lecture, must be taken by the bearers of the stretcher.

\* *Surgeon's Pocket Book*, Surgeon-Major Porter.

*Fractures of the leg*, between the knee and ankle, are about the commonest accidents of importance at collieries and other large works. They occur frequently also among those who follow less laborious occupations, being caused by kicks from horses, carriage accidents, heavy falls, kicks at football, jumping or stumbling from great heights, and other kinds of violence. They are second in importance only to fractures

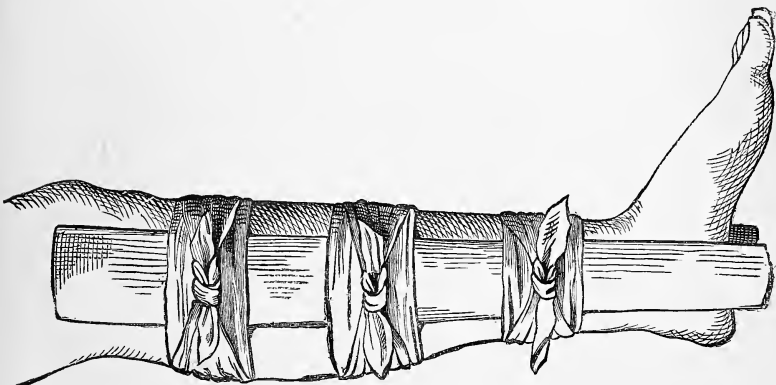


FIG. 31.—Wooden Splints for a Broken Leg.

of the thigh ; and as you might expect from the exposed and superficial position of the larger bone of the leg, or shin-bone, compound fractures of the leg are more common than similar injuries in any other part of the body. A simple fracture of the leg is, for the same reason, very easily converted by careless, rough, or unskilful handling into a compound one ; and though such a mishap is not usually attended by the danger that attends a compound fracture of the thigh, still at the very best the suffering of the patient is much increased and his recovery greatly delayed. This, especially in the case of a working man, is a most serious matter. If he has no club, no money at all is forthcoming ; and if he has a club, about half—or it may be only a quarter—of the amount of his usual wages is all there is to support himself and his family. And this state of affairs lasts two or three months longer, looking at it in its most hopeful light, than if the case had been one of simple fracture. There is always the chance, too, of the surgeon being obliged to amputate the

man's leg to save his life; and if the case progresses unfavourably there is further the risk of a fatal result. I am not at all exaggerating. This story of disaster has followed over and over again the careless or unskilful handling of a broken leg by well-meaning but badly-informed friends.

The usual signs of fracture are present when a leg is broken. There is swelling, and the shape of the limb is unnatural; there is crepitus; on passing your finger down the large bone of the leg you can feel the irregularity caused by the ends of the broken fragments at the seat of fracture; and the patient complains of pain and is unable to use the limb. When both bones of the leg are broken the nature of the injury is usually very plain; but if only one bone is

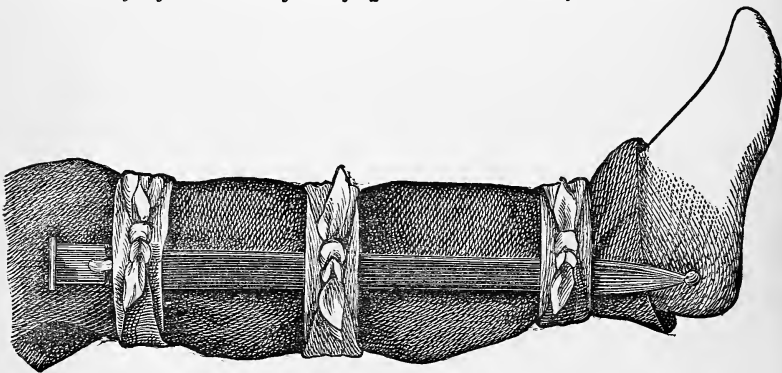


FIG. 32.—Scabbard as Splint for a Broken Leg.

fractured, then the sound bone acts as a splint for it, keeping it in position, and there is more difficulty in telling what has occurred.

If you have the necessary materials at hand, you should support the injured limb by binding on two splints—one on the outer side, one on the inner side, of the leg (Fig. 31). These splints should be properly padded, if made of hard material such as wood; but, as I have already explained to you, very good temporary splints may be made of rolls of straw, or straw bottle-casings, wrapped up in cloths or handkerchiefs (Fig. 30), folded newspapers, cardboard, and similar articles. The diagrams (Figs. 32 and 33) show how fractured legs may be put up with bayonets and bayonet scabbards; and in these illustrations you will observe that



the trousers are made use of as padding. When you have securely bound on your splints you should tie the legs together at the knee and ankle, so that additional support may be given to the injured limb by the sound one. If you cannot get anything to make splints of, the sound leg must serve as your splint, and you should place some pieces of clothing, hay, or straw between the limbs, and bind them securely together. Should there be a board handy, you could place it under the two limbs, and fasten them to it; or if on the battlefield, you could bind the two legs together and support them on a knapsack in the same way, but you should always remember to use something soft, as straw, fragments of clothing, etc., to place between and under the legs so as to make

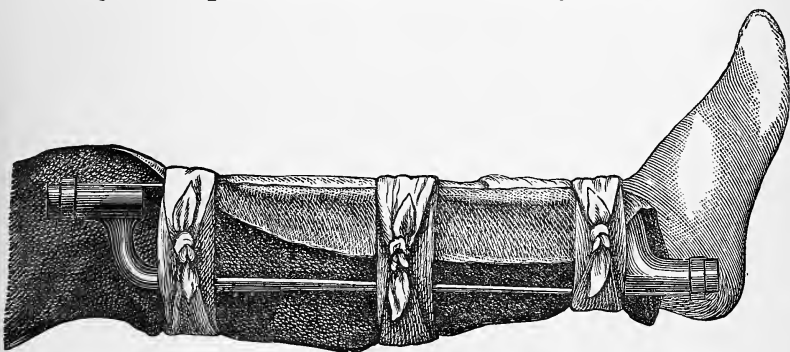


FIG. 33.—Splint made of two Bayonets for a Broken Leg.

the patient as comfortable as possible. When you have secured the broken limb by one or other of these methods the patient is ready to be moved away on a stretcher.

The *knee-cap* is fractured sometimes by heavy blows or falls, but it is more usually broken by violent efforts to recover oneself after slipping, the bone being, so to speak, torn across by excessive muscular action. In these fractures there is no shortening of the limb, and the two fragments of the bone, which are separated one from the other, can be readily felt. The leg is perfectly useless, the patient being unable to stand upon it or to raise it; and the more the knee is bent, the farther the two pieces of bone are separated. In an accident of this kind you can either apply a splint to the back of the limb, and bind a hankerchief or scarf around the

knee like a figure of eight, so as to keep the two fragments of bone as near together as possible ; or if you cannot improvise a splint, you should tie the two limbs together at the ankle, knee, and thigh. Always keep the limb as straight as possible, and a little raised.

*Fractures of the bones of the foot* are the result of great violence, so that there is considerable pain and swelling of the injured part. The foot looks an unnatural shape and you may be able to feel crepitus. All you can do is to keep the foot raised, and apply cold by means of sponges, folded handkerchiefs, or cloths steeped in cold water.

So far I have been speaking to you about fractures or broken bones, and explaining to you the best way of giving first aid in such cases. But there are other injuries to the skeleton with which you may meet besides fractures. A bone may, without being broken, be displaced, put out of joint, or *dislocated*. Most of you have heard of, and perhaps known, some one who has had his "shoulder put out," his "elbow out," or his "jaw out." Such injuries are spoken of as *dislocations*—dislocation of the shoulder, elbow, jaw, etc., as the case may be. This displacement, or unjointing, of a bone is a very different thing from a fracture, and is just one of those accidents for which you can give no help, except by assisting the patient along, or carrying him to his home or to the nearest doctor. *Never interfere with a dislocation, but leave it to be taken in hand by a qualified medical man.* By meddling with an injury of this kind you may do great harm ; but if you wish to display your zeal, send for the doctor, or help to convey the patient to where he will receive professional assistance.

In fractures it is in your power to give most valuable help before medical aid can be procured ; in dislocations you must attempt nothing, but leave everything to the surgeon. You should therefore be able to distinguish fractures from dislocations. The bones of the limbs may be either broken or displaced as the result of violence : in either case the patient is unable to use his limb, and there is pain at the seat of injury, with distortion—or an unnatural shape—of the limb. In a fracture, however, the seat of injury is usually somewhere about the middle part of the bone—not at a joint ; there is crepitus—or grating between the broken ends of the bone—felt and sometimes heard on movement of the injured part of the limb ; the limb is unnaturally movable at the seat of

the fracture ; there is frequently shortening of the limb from one of the broken ends of the bone overriding the other ; and often the rough ends, edges, or sharp points of the broken ends of the bone—or some irregularity—can be felt at the seat of fracture.

In a *dislocation*, on the other hand, the seat of injury is at a joint ; there is no crepitus ; the injured joint is more or less fixed and immovable ; and there may be either shortening or lengthening of the limb. In dislocation of the jaw the mouth is open and the jaw fixed ; there is no crepitus, or irregularity of the line of the teeth and the lower margin of the jaw (as there is in fracture), and in many instances it is caused by gaping. Women are the most frequent sufferers ; and if the accident occurs once, the patient has to be very careful in future, or the jaw will slip out of place again. Indeed after any joint has once been dislocated the different tissues (such as the ligaments, etc.) of the affected part are so weakened that displacement of the bones will much more readily occur from some violence or incautious movement than at the time of the first accident.

### SPRAINS AND STRAINS.

Sometimes, from over-exertion, or from slipping on rough ground, a joint gets wrenched, twisted, or *sprained*. The joints most frequently injured in this way are the wrist and ankle. Colliers, labourers, and others who work hard with their arms often get their wrists sprained ; and sprained ankles are pretty frequently caused by slipping over a loose stone, stepping in a rut or hole, or “turning your foot.” In these accidents the ligaments, tendons, and other tissues about the joint are stretched, twisted, and torn to a greater or less extent ; the small blood-vessels of the part are ruptured as well, so that blood escapes underneath the skin in and about the joint, causing swelling and a bluish-red discoloration. These injuries, as some of you know from bitter experience, are often extremely painful. If the pain is very severe, soak the injured part in hot water thoroughly—as hot as can be conveniently borne for about a quarter of an hour,

and then apply a good large hot bran poultice. This usually gives great relief; but if hot water cannot be obtained, or should hot applications fail—as in some cases they do—to give much ease, then apply cold, in the form of cloths, handkerchiefs, clean soft rags, or sponges, steeped in cold water, spirit and water, or vinegar and water, taking care to keep your applications constantly cold and wet. But always remember, whatever else you do, to give the injured joint *absolute rest*, and to keep it continually in a *raised position*. Later on, when the pain is relieved and the swelling has more or less subsided, friction and stimulating liniments, such as hartshorn and oil, are useful.

Sprains or *strains* of the muscles or flesh of the back, loins, hips, and shoulders, are rather common amongst labourers, platelayers, and others who get their living by manual labour. The pain and stiffness caused by these muscular sprains or strains is best relieved by hot fomentations and bran poultices, followed by good hard rubbing with a strong liniment of hartshorn and oil.

### CONTUSIONS OR BRUISES.

These are caused by violence, as falls, blows, squeezes, etc., and are every day occurrences. They may be extremely trivial, or very severe. In these injuries the skin is not broken, but the soft tissues underneath the skin are more or less torn and lacerated; the small blood-vessels are torn and the blood escaping from them causes swelling and discoloration of the bruised part. The colour varies from a purplish-red at first to a greenish-brown or yellowish tint later on. You may study these changes of colour conveniently in the next black eye you see. In trivial contusions you can apply cold by means of wet sponges, cloths, or handkerchiefs; but for severe and extensive contusions, such as I often find colliers suffering from, as the result of heavy falls of coals and dirt from the roof of the pit, there is nothing that gives so much relief as copious hot fomentations, followed by large thick bran poultices, over which vinegar has been sprinkled.

In very severe contusions, such as those occurring from railway accidents, heavy falls of rock, and other forms of

great violence, one or more of the important internal organs, such as the liver and intestines, are sometimes torn, and then the case is a most dangerous one. You can usually tell that something very serious has happened by the faint, pale, and prostrate condition of the patient. I shall speak of this prostrate state—or, as it is called, collapse—in the next lecture.

## LECTURE IV.

## SUDDEN ATTACKS OF ILLNESS, SUFFOCATION,\* ETC.

First aid in cases of shock, stunning, compression of the brain, apoplexy, epilepsy, fainting, and intoxication—The immediate treatment of the apparently drowned, or otherwise suffocated—Burns, scalds, sunstroke, and frost-bite—Poisons—Bites from rabid and venomous animals—Foreign bodies in the nose, ear, and eye.

## SHOCK OR COLLAPSE.

WHEN a man meets with a very severe accident, such as having one of his limbs shattered, he not only suffers pain at the seat of injury, but he is altogether shaken. His whole system receives a shock; his face is pale, pinched, and haggard, and bears a vacant yet anxious and alarmed expression; he is frightened, faint, depressed, and complains of cold; he has lost all his "pluck"; he trembles and staggers; his skin feels cool and clammy; his breathing is feeble and labouring; his pulse is extremely weak, and sometimes can scarcely be felt. His friends say that he "has the fright in him," or that he is "upset." When a man is in this condition as the result of an accident, he is said to be suffering from *shock* or *collapse*. A person may die from shock immediately, as in accidents from lightning; or he may sink in a few hours after some terrible injury, such as an extensive burn, shattering of a limb, or wound of the cavity of the belly. In other instances the shock is very slight, and the patient soon rallies. People, as you know, differ very greatly in temperament, and an accident that would cause intense shock in one man would affect another to a very trivial extent. Weak, nervous, and timid people suffer more severely from shock generally than strong and robust ones. The signs of shock usually appear immediately after an accident; but in some instances they are delayed, and seem to be for a time controlled by the strong self-command of the

\* Or, as it is called technically, *asphyxia*.

injured man, or else kept under by the all-powerful instinct of self-preservation. Thus a soldier who had his arm taken off close to the shoulder at the battle of Waterloo by a cannon-ball, rode upright for fifteen miles to Brussels, but became insensible from shock on his admittance into the hospital.\* There is a peculiarity about shock that any of you who have had the misfortune of witnessing many accidents must be aware of. It is that the severity of the shock by no means always corresponds with the severity of the injury which causes it. When a man meets with a very severe and painful accident, you would naturally expect dangerous collapse as a result, and this is usually the case. But it is not always so, for people who are possessed of great determination and high spirit not unfrequently bear up with wonderful "pluck" and fortitude, even when very severely and dangerously hurt. On the other hand, it often happens that the signs of shock are severe, out of all proportion to the injury received, and a man who has been but slightly wounded is sometimes placed in extreme danger from the shock that follows. Death, indeed, occasionally occurs from shock when the injury itself is quite insufficient to account for it.

When a man is suffering from shock he is depressed, so you should speak kindly to him, try to cheer him up, and give what encouragement you can. He is faint, so you should place him in a lying-down position—flat on his back. He is cold, so you should cover him with clothes, blankets, or your own coat if there is nothing else handy, and put hot-water bottles, or heated bricks wrapped in flannel, to his feet, apply friction to the hands and surface of the body, and give him, if he is not perfectly insensible, some warm broth, tea, coffee, or (*if there is no risk of bleeding*) a little spirit or wine, mixed with hot water, to drink. If the patient is quite insensible, you can apply sal-volatile or smelling salts to the nostrils; but do not try to make him swallow anything, or he may choke. In all cases take care to remove anything tight about the neck, as the collar, necktie, etc.

\* *Gunshot Injuries*—Surgeon-General Longmore.

## CONCUSSION OF THE BRAIN OR STUNNING.

When a man is *stunned* he is said to suffer from *concussion of the brain*. Stunning is caused by falls or blows on the head, and may be very severe, even fatal, or it may be extremely trivial. Most of us have had personal experience of slight concussion or stunning, and remember the giddiness and the stupid confused feeling which lasted a few minutes after a fall or a blow on the head, and then passed away. When the injury to the head is severe, the patient lies motionless and insensible, the pupils of the eyes are contracted, the face is pale, the skin feels cold, the pulse is weak, and the breathing slow and quiet. If he is roused or addressed in a loud voice, he answers peevishly, and falls back again into insensibility. By and by he gets uneasy, tosses about, vomits, and then quickly comes to himself. In bad cases the patient is perfectly insensible and cannot be roused at all; the pulse is very weak and irregular, the skin is cold and clammy, and he either dies or recovers very slowly.

In a case of stunning, place the patient in a lying-down position with the head slightly raised; keep him perfectly quiet, remove any tight articles of clothing, see that he has plenty of fresh air, wrap him up in blankets, and put hot-water bottles to his feet; and apply cloths, folded handkerchiefs, or sponges steeped in cold water, to his head.

## COMPRESSION OF THE BRAIN.

Unfortunately much more serious mischief than stunning is often caused by accidents to the head. The skull may be broken, and a fragment of bone driven against the brain, or a blood-vessel may be ruptured inside the head with bleeding in the cavity of the skull—the blood pressing upon the brain.

In these cases of *compression of the brain* by pieces of bone or accumulated blood, the symptoms are very grave. The injured man lies in a state of complete insensibility; the pupils of the eyes are insensible to light, and one or both are dilated; the eyes themselves are quite insensible to touch—this of course shows how deeply insensible the patient is;



the breathing is deep and snoring, and there is a puffing or blowing movement of the cheeks and lips—these being blown out during expiration, and drawn in during inspiration; the pulse is slow and full; there is more or less complete paralysis, and sometimes convulsive movements; and there may be drawing of the face to one side, or squinting. As you might expect, persons injured in so serious a manner often die at once; but in a case of this kind, however bad it looks, never refuse your help because you think it useless. While there is life there is hope. It is, moreover, well to remember the saying of one of our greatest surgeons—Liston—"That no injury of the head is too trivial to be despised, or too serious to be despaired of."

I have already explained to you, when speaking of fractures of the skull, how you may best give aid in cases of compression of the brain.\*

All the conditions I have so far been describing to you—shock or collapse, stunning or concussion, and compression—are the results of injury; but there are also certain kinds of disease—associated with a state of insensibility—which it is very necessary you should know something about. I allude to certain forms of sudden illness which are often met with, which frequently cause the greatest alarm, fright, and dismay among the bystanders and the relatives of the patient, and for which you can generally give valuable assistance before it is possible to obtain professional advice. I refer more particularly to those sudden and unexpected seizures which you know by such names as "strokes," "fits," and "faints"; and I also include certain forms of poisoning, viz. those in which there is insensibility or loss of consciousness.

#### APOPLEXY—APOPLECTIC FIT—STROKE.

A man beyond middle age goes to bed apparently in good health, having taken a heavy supper; in the morning he is found helpless, his face flushed, and his mouth drawn a little to one side; he has a difficulty in speaking, so that you cannot well understand what he says; he moans, and tries to direct your attention to the arm and leg of *one* side of the body, and on examination you find they are perfectly

\* See Lecture III.

helpless, and perhaps also devoid of feeling or sensation. If you lift either limb up a little, and let it go, it falls a dead weight and useless, and the patient has no power to move it. If you pinch either limb the patient in many instances does not feel you. The man has had a *stroke*: a diseased blood-vessel has given way in his brain, there has been internal bleeding, and the pressure of the escaped blood on the tissue of the brain is the cause of the symptoms I have described. In more severe cases the patient lies completely insensible, snoring loudly, the cheeks and lips puffing out with expiration and being drawn in with inspiration, the pupils of the eyes fixed and unequal in size, with more or less complete paralysis—in fact, with symptoms such as I described as resulting from compression of the brain.

Apoplexy is rather common amongst those who are in advanced years, and the seizure often occurs in the early morning, so that the sufferer is found helpless in bed. In other cases the patient is taken suddenly ill when sitting at a meal or going about his daily occupation, and he either falls insensible or sinks to the ground from the sudden loss of power of one side of the body.

In an emergency of this kind you may do great harm by attempting too much. You should lay the patient quietly in a lying-down position with the head slightly raised; and if he is not already in bed, take advantage of the nearest sofa, or get a bed or mattress moved into the room where the man was taken ill. The less you move the patient about or disturb him the better, for any rough or unnecessary movements are likely to increase the bleeding from the ruptured blood-vessel, and so make bad worse—probably, indeed, lead to fatal results. Loosen anything tight in the way of clothing, as the collar, waistcoat, braces, necktie, or scarf. Place hot-water bottles against the feet, and apply cold wet folded handkerchiefs, cloths, or sponges to the head, or ice broken up in small bits and tied in a bladder. See that the patient has plenty of fresh air. If the room is close open the window, and do not let the sick-room be crowded with noisy, sympathetic inquirers. Keep the patient still and quiet, and prevent him from being annoyed, excited, and worried by attempts at conversation. Do not give him anything to drink—stimulants are especially to be avoided, but send at once for a medical man, and wait for further instructions from him.

## EPILEPSY—EPILEPTIC FITS—FALLING SICKNESS.

Attacks of *epilepsy* are spoken of usually as *fits*. Many of you know people who are liable to these attacks, and some among you have frequently witnessed the seizures themselves. There is no mistake about an epileptic fit—no shamming or imposture. The patient when attacked falls suddenly, often with a moan or cry of some sort. It does not matter where he is, or what he is doing—he may be at his work, having his dinner, standing at the edge of a precipice, or warming himself before a fire; but when the fit comes on he falls suddenly—as suddenly as though he were shot dead—and he is *quite insensible*. Thus it happens that people subject to these fits are often badly hurt. It is common for them to bruise themselves severely by falling against something hard. If a man has a fit and tumbles into a fire he will, if no one is present to give help, be severely burnt—perhaps burnt to death; in the same way, if he should be seized on the brink of a precipice, he will fall down and be killed. The attack is sudden, and the insensibility complete; but the patient is not quiet and still. On the contrary, he works hard in the fit—his face is livid, his pupils dilated, his eyes roll, and his features are twitched and drawn all ways; there is a chewing movement of the mouth, the tongue gets between the teeth and is bitten, and the patient foams and froths at the mouth. At the same time the breathing is laboured, and the arms, legs, and trunk are twisted, jerked about in all directions, and twitched—in fact, violently convulsed. There is usually more or less twisting around towards one side in the fit. This is particularly noticeable in the head, which looks as if the patient was straining around and trying to look over his shoulder at something behind him. Altogether an epileptic fit is about the most horrible sight you can witness, and once seen is not readily forgotten.

You cannot stop a fit; it will have its own way, and take its own time; but you can prevent the patient from hurting himself. Remove him, if necessary, from a position of danger, and see that nothing interferes with the freedom of his breathing. He may fall across a line of rail, on to a fire-place, or in some other awkward and dangerous position.

Your first business would then, of course, be to get him into a place of safety. Next you should see that there is nothing tight about the neck and chest hampering his breathing. Remove or loosen his collar and scarf, and undo his waistcoat. Let him lie on his back, and slightly raise the head. You may save his tongue from being bitten by pushing a cork, a rolled-up handkerchief, a piece of indiarubber,—anything, in fact, handy and suitable,—between the teeth. Do not attempt to forcibly hold or tie the patient, but simply try and control the violent jerking movements of the limbs to some extent with your hands, so as to hinder the sufferer from hurting and severely bruising himself. After the fit the patient is often stupid, heavy, and sleepy, and it is best to let him rest quietly for some hours.

#### HYSTERIA—HYSTERICAL EPILEPSY—HYSTERICAL FITS.

There is one form of disease which somewhat resembles epilepsy. It is called *hysteria*, and is usually found in weak nervous girls or young women. You may form some idea of it by considering it to be sham epilepsy. The girl never bruises herself, never tumbles down a precipice or into a fire, never hurts herself at all, never even tears her dress; she does not entirely lose consciousness, and never bites her tongue, though there may be frothing at the mouth, spluttering of the lips, and jerking movements of the head and body. She never has an attack unless there is some one present to witness it, and she is generally in an excited state—talking, laughing, or crying—when the seizure occurs. You need never be alarmed for the safety of the patient in a case of this sort. Show you are not alarmed by your manner, and ask unsympathetically and loudly (so that the patient may hear) for a jug of cold water. This will help to bring her round, and the cure will probably be completed when you dash the cold water smartly over her face and head.

#### SYNCOPE—FAINTING—FAINTING FITS.

When a person's heart from any cause works feebly and fails to pump up a sufficient amount of healthy red blood to the brain and head, the face becomes ghastly white, the lips

even turn pale, there is a sensation of giddiness or “swimming” in the head, a feeling of sinking at the pit of the stomach, a singing noise in the ears, surrounding objects seem to float up and down, the pulse becomes very weak, and can scarcely be felt, and the man falls down insensible—in other words, he *faints*. Fainting may be brought about in many ways; it may be caused by bleeding, by heat, fright, sitting in a close room, going long without food, over-fatigue, general weakness, exhaustion, hearing bad news, etc. When giving first aid in cases of fainting your object is to restore the circulation of blood in the brain and head, so you should lay the patient down flat, with his head on or below the level of the body, and keep him in that position until he is better. Loosen the clothing about the neck and chest—the collar, necktie, shirt, and waistcoat. Let the patient have plenty of fresh air; if he is in a room open the window; if outside keep people from crowding around; dash cold water on the face, and, if they are at hand, apply sal-volatile or smelling-salts to the nose. Of course, if there is bleeding, you must at once arrest it, and when the patient revives sufficiently to swallow give him a little stimulant, as wine or weak brandy and water, to drink. It may happen that a man faints in a narrow confined space, so that he cannot be laid down flat on account of want of room. In such a case you should get his head as low as possible by pressing it well down between his knees.

But I must remind you that loss of consciousness or insensibility is not always the result of either injury or disease. It may be caused by certain poisons, as alcohol and laudanum. These substances, like arsenic, strychnine, and deadly nightshade, are very useful when given in proper doses at the right time in many cases, but if taken in too great a quantity hurtful effects are sure to follow.

#### INTOXICATION—DRUNKENNESS—POISONING BY ALCOHOL.

There seems to be a mistaken idea amongst many people that “drink” never kills rapidly, but that persons who die from taking too much stimulant only sink after months—it may be years—of hard drinking. Never was there a greater mistake. Cases of acute poisoning from taking excess of stimulant are unfortunately too frequent. Men have been

known to die on the spot, from shock to the nervous system, after swallowing large quantities of spirit, and death from the same cause after a few hours is, comparatively speaking, a common event.

When a man is in danger from drinking he is in the stage of drunkenness usually described as "dead drunk." He lies helpless and insensible, his face often flushed and bloated, the pupils of the eyes equal in size, dilated, and fixed, the eyes themselves reddened, the lips livid, the breathing slow, the pulse soft and quick, and the body cooler than natural—the temperature being two or three degrees lower than it should be; the breath smells strongly of spirits or other stimulant; there is no squinting or drawing of the face, no frothing at the mouth, nor biting of the tongue, but the patient lies motionless and speechless, all the limbs being equally helpless.

People in this helpless stage of drunkenness are in a position of great danger, particularly if they are lying out in the cold; for, as I have told you, the heat of the body is much lower than natural when a man is intoxicated, and if he fails to reach home on a sharp frosty night the probability is that his drinking bout will end in the sleep of death. It is too much the fashion for people to pass men lying insensible on the roadside without taking any notice of them. They are so eminently respectable and so morally perfect themselves that they cannot possibly even look at any poor creature lying helpless and unconscious if they have the slightest suspicion that he has been drinking. Let me tell you that if you pass a man lying insensible without giving what assistance you can—without even informing the police or others—so that help of some kind and the means of removal may be obtained, you are guilty of gross and culpable neglect, you fail in your duty as a Christian, and you may indirectly be the cause of the man's death.

In these cases of intoxication, always get the patient under cover as soon as possible. If he is deeply insensible, try and rouse him by dashing cold water on the head and face. The effect of this is sometimes wonderful, the patient commencing to breathe well and deeply almost immediately after the application of the cold douche. Endeavour to make him vomit by tickling his throat with a feather or—if he is capable of swallowing—by giving him an emetic of mustard and water. Apply friction to the surface of the body by rubbing

the limbs and trunk well with warm dry cloths or flannel. Wrap the patient in blankets and put hot-water bottles to his feet, for it is of the utmost importance that the warmth of the body should be maintained. Never forget that the heat of the body in intoxication is lowered, whereas in apoplexy it is raised.\* For this reason it has been suggested that police-officers should be taught how to take the temperature of those found in an insensible condition, as such instruction would be of help in distinguishing between apoplexy and drunkenness, and would, moreover, suggest the immediate "abolition of the practice of thrusting the really intoxicated into a cold and damp cell, which to such a one is actually an ante-room to the grave."†

### POISONING BY OPIUM, LAUDANUM, ETC.

In poisoning by laudanum and other substances containing opium the patient becomes sleepy and passes into a state of insensibility. The pupils of the eyes are contracted to the size of a pin's point, the breathing becomes slower and slower, and the insensibility deeper and deeper. The great thing in a case of this kind is to make the patient vomit as soon as possible by the administration of emetics, and to keep him awake by walking him about, dashing cold water on his head and face, and giving him strong coffee to drink. If the breathing should cease, artificial respiration (which I shall describe later on) must be resorted to.‡

### BLOOD POISONING FROM KIDNEY DISEASE.

When the kidneys from any cause become diseased, they fail to perform their proper function of excreting or getting rid of certain hurtful materials which result from the decay, waste, and wear and tear of the different structures of the body. These products of waste, therefore, accumulate in the blood and act as poisons, giving rise to insensibility and convulsions, which more or less resemble epileptic fits in their appearance. In these cases the patient has usually com-

\* The usual temperature in health is 98° Fahr.

† *Cantor Lectures on Alcohol*, Dr. B. W. Richardson.

‡ The whole subject of poisons is discussed on pages 120-122

plained previously of illness, and there is moreover generally dropsical swelling of the lower limbs and face—it may be, indeed, of the whole body. If you meet with a case of this description, and recognise its nature, you should apply cold to the head, a mustard poultice across the loins, and administer (if the patient is able to swallow) any household aperient medicine, such as castor oil, etc.

The different varieties of *insensibility* or *loss of consciousness* may be conveniently arranged in a table, which may enable you to get a clearer idea of their several causes:—

- |  |   |
|--|---|
| 1. Injuries of any kind in<br>any part of the body                                     | } Shock or Collapse.  |
| 2. Injuries to the Head  |   |
| 3. Diseases of the Brain   | } Stunning or Concussion.<br>Compression of Brain.<br>Apoplexy.<br>Epilepsy.<br>Hysteria. |
| 4. Fatigue, Fright, Bleeding,<br>Debility, etc., causing failure of<br>heart's action. |   |
| 5. Poisoning.  |   |

Intoxication  
Opium poisoning.  
Poisoning of the blood due to  
kidney disease.

I will finish my remarks on this subject by describing the precautions you should take, and the way you should set about trying to discover what is the matter, when you meet with any one lying helpless and more or less completely insensible.

Always be particular to note the position of the body and its surroundings; the case may end in a law court, and you may have to give evidence as to marks of blood, torn clothing, bruises, knives, or other weapons, the state of the ground—whether much trampled on, etc.—the posture in which you found the body, and other similar matters. Try and find out the cause of the patient's condition. Due attention to the surroundings may help you in this; thus, if the patient is lying prostrate at the foot of a ladder or high scaffolding you would suspect concussion, compression, or other injury resulting from a fall; or if there is an empty bottle labelled laudanum, or a flask smelling of whisky, lying near, you would think the man had taken poison or had been drinking.



But without loss of time you should place the patient flat on his back, with the arms to the sides and the legs extended straight close to one another, and the head slightly raised if the face is flushed, but perfectly flat if the face is pale. If there is the slightest inclination to vomit, the head should be immediately turned to one side, or the patient may be choked by the matters rejected from the stomach. You should also loosen all tight clothing about the neck and chest—collar, scarf, shirt, braces, and waistcoat—so that nothing may interfere with the breathing or with the return of blood from the head; and you should carefully examine the head, trunk, and limbs for any signs of injury—wounds, bruises or fractures. The position of some injury may be indicated by blood, torn clothing, or by the patient clutching the part that is hurt. If the head is injured you would suspect concussion, or, if there are fixed dilated pupils, stertorous or snoring breathing, squint, drawing of the face to one side, or other signs of serious brain mischief, compression. If the trunk is severely wounded, or one of the limbs badly hurt or shattered, then you would think of shock; whereas if there is smart bleeding going on, and the face and lips of the patient are ghastly white, then you would judge that the case was one of fainting. If there is arterial or venous bleeding going on you should of course arrest it promptly; and if the patient is in a violent epileptic fit, which you could hardly fail to recognise, you should endeavour to prevent him biting his tongue or otherwise hurting himself. If the patient does not appear to have sustained any injury, but is flushed, deeply insensible, his skin feeling hot, his pupils fixed and dilated—one bigger than the other—his face drawn to one side, his breathing of a snoring character, etc., then you would consider you had apoplexy to deal with. If the breath smells strongly of brandy or other stimulant, and the face is bloated and flushed, the eyes red, the pupils dilated and equal in size, the skin cool and clammy, and the pulse full and quick, then the patient is probably dead drunk. In opium poisoning the pupils are contracted to a pin's point, and this, with the slow breathing, the deepening insensibility, with the absence of any smell of stimulant, should make you suspicious of the true state of the case. If you have to deal with an insensible person, it is always best and safest to obtain medical aid as quickly as possible; and if a doctor does not happen to be near, it is better without loss of time to

convey the patient on a stretcher or in a trap to the nearest hospital or surgery. In many cases it is extremely difficult to ascertain the cause of the insensibility. Indeed, there is not unfrequently a complication. Thus, a man may be dead drunk and apoplectic at the same time; or he may be so deeply and dangerously intoxicated that all your attention becomes concentrated on his drunken state to the neglect of some important injury from which he is suffering as well—such, for example, as broken ribs or a fractured thigh.

### DROWNING.

The following directions for restoring persons apparently drowned are taken, with but slight alteration, from the instructions issued by the Royal Humane Society:—

Send for medical assistance, blankets, and dry clothing, but proceed to treat the patient *instantly*; and, when possible, *in the open air*, exposing the neck, face, and chest to the wind, except in extremes of weather, as intense cold, heavy rain or snow, etc.

The points to be aimed at are, *first* and *immediately*, the restoration of breathing; and *secondly*, after breathing is restored, the promotion of warmth and circulation.

The efforts to restore life must be persevered in until the arrival of medical assistance, or until the pulse and breathing have ceased for an hour.

### THE SYLVESTER METHOD OF RESTORING NATURAL BREATHING.

*Rule 1. To adjust the patient's position.*—First lay the patient flat on his face, supported by folded articles of clothing, with one of the arms under the forehead, and the head rather lower than the body, so that any water in the mouth and air-passages may drain off; then quickly place the patient on his back, or on a flat surface, inclined a little from the feet upwards; raise and support the head and shoulders on a small firm cushion or folded article of dress placed under the shoulder blades. Remove all tight clothing from about the neck and chest, such as collar, neck-tie, scarf, braces, stays, belt, etc.

*Rule 2. To maintain a free entrance of air into the windpipe.* Cleanse the mouth and nostrils; open the mouth; draw forward the patient's tongue and keep it forward. An elastic band over the tongue and under the chin will answer this purpose.

*Rule 3. To imitate the movements of breathing.—Firstly,* induce inspiration.—Place yourself at the head of the patient, grasp his arms, raise them upwards by the sides of his head, stretch them steadily but gently upwards for two seconds. (By this means fresh air is drawn into the lungs by raising the ribs; see Fig. 34, Inspiration).

*Secondly,* induce expiration.—Immediately turn down the patient's arms, and press them firmly but gently downwards against the sides of his chest for two seconds. (By this

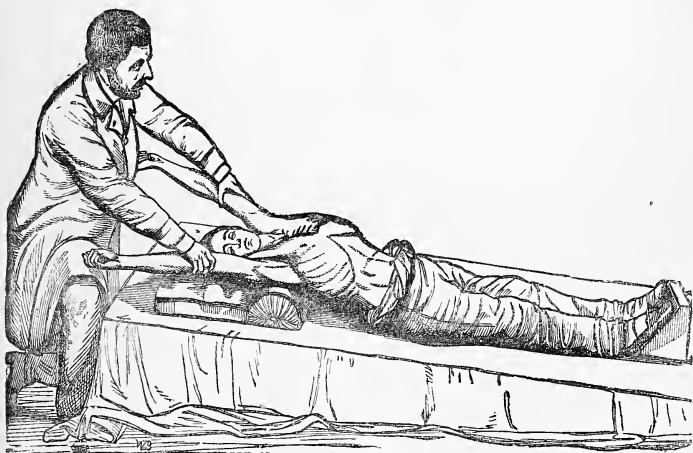


FIG. 34.—Dr. Sylvester's method of performing artificial respiration—*Inspiration.*

means foul air is expelled from the lungs by depressing the ribs; see Fig. 35, Expiration).

*Thirdly,* continue these movements.—Repeat these measures alternately, deliberately, and perseveringly fifteen times in a minute, until a spontaneous effort to respire be perceived. (By these means an exchange of air is produced in the lungs similar to that effected by natural respiration).

*Rule 4. To excite respiration.*—While you are busy performing artificial respiration, some one else should excite the nostrils with snuff or smelling salts; tickle the throat with a feather; rub the chest and face briskly, and dash cold and hot water alternately on them, or flap the chest with a wet towel; and rub the body and lower limbs with dry flannel or cloths.



FIG. 35.—Dr. Sylvester's method of performing artificial respiration—*Expiration.*

#### TREATMENT AFTER NATURAL BREATHING HAS BEEN RESTORED.

*To induce circulation and warmth.*—Wrap the patient in dry blankets or warm clothing (which, if necessary, can usually be borrowed from the bystanders); and rub the limbs upwards energetically, thus pressing the blood along the veins towards the heart. Promote the warmth of the body by hot flannels, bottles or bladders of hot water, heated bricks, to the pit of the stomach, the armpits, and to the soles of the feet.

On the restoration of life, when the power of swallowing has returned, a teaspoonful of warm water, small quantities of wine, warm brandy and water, or coffee, should be given. The patient should be kept in bed, and a disposition to sleep encouraged. During reaction large mustard plasters to the

chest and below the shoulders will greatly relieve the distressed breathing.

These directions are so simple that you cannot fail to easily understand them, and I wish you to study them very carefully; and when you meet for practice you should try to imitate the movements of breathing, or, in other words, perform *artificial respiration*, one on the other. The method of performing artificial respiration recommended by the Humane Society is that introduced by Dr. Sylvester; there are, however, several other methods, notably those of Dr. Marshall Hall, and Dr. Howard of New York. All these various plans are only different ways of doing the same thing—viz., imitating as closely as possible the movements of natural breathing. It is better that you should confine your attention only to *one* method of performing artificial respiration in order to avoid confusion; and that introduced by Dr. Sylvester is, I think, the best one for you to adopt, because, first it is found to be very successful; secondly, it can be performed by *one* person alone; and thirdly, it is very simple, and does not require any great amount of skill to practise it.

### HANGING.

Suicides not unfrequently choose this way of destroying themselves. Should you meet with a case, cut the body down immediately. You may be surprised that I should direct your attention specially to what your own common sense would, or ought to, tell you; but I do so purposely, as it too often happens that very precious time is wasted by persons, when they see a body hanging, running off to tell some one else what has occurred. Your only chance of doing any good, if you meet with a case of this kind, is to cut the body down *at once*, and loosen the noose around the neck, taking care, however, while you do it that you so support the body with one arm as to prevent further injury by a heavy fall. Loosen anything tight in the way of clothing about the neck and chest, such as the collar, necktie, waistcoat, shirt, and braces. Let the patient have as much fresh air as possible—if in a room open the window. Dash cold and hot water alternately on the face and chest, and use vigorous friction to the limbs and body by means of dry

flannels or cloths. Apply snuff or smelling-salts to the nostrils; and endeavour to restore natural breathing by artificial respiration.

### SUFFOCATION BY GASES.

Persons may be suffocated by breathing "choke-damp" in mines, charcoal vapour, sewer gas, the vapours from burning lime-kilns, brick-kilns, and cement-kilns, the smoke in a burning house, coal gas, the vapours from blast-furnaces, the foul air in wells, cellars, deep cuttings and excavations, and the close confined air of overcrowded rooms. In these cases the great thing is to drag the patient as quickly as possible into fresh air. Unfasten the clothing about the neck and chest. Dash cold water on the head, face, and upper part of the chest; and if the breathing has stopped resort to artificial respiration.

### CHOKING.

People are occasionally in danger of suffocation, and sometimes actually die, from pieces of food, coins, or other substances sticking in the throat in such a way as to stop, more or less completely, the passage of air into the windpipe. If the entrance to the air passages is completely blocked of course insensibility and death rapidly follow, unless the obstruction is speedily removed. In most cases, however, it fortunately happens that the block is not complete, so that there is more time for help to be given to the patient by those about him. Most of you know very well from personal experience the signs of choking—the distressing difficulty of breathing, the cough and retching, the violent efforts to get rid of the offending substance, the dusky bluish colour of the face, the prominence of the eyes, the tossing about (by the sufferer) of his arms or the clutching of his throat—followed, if relief is not speedily obtained, by unconsciousness. In bad choking, where the patient suddenly turns dark in the face, throws his arms out wildly or snatches at his throat, and falls insensible, no time is to be lost. You

must open the mouth, and push your forefinger over the tongue right back, and try to hook away or push aside the obstructing substance. If you do not succeed in this you may—by pressing the hinder portion of the tongue—bring on vomiting and so get rid of the obstruction. A good plan is the one which you see so often practised with children, viz. that of pressing the chest and stomach against something hard, as a table or a chair, then slapping or thumping the back between the shoulder blades; in this way air is driven from the lungs along the windpipe so forcibly as often to dislodge the obstruction. Another good plan with a child is to take the little patient up by the heels and give it a shake or slap its back at the same time. This method has at times acted very successfully, particularly where the obstruction consisted of a coin, as a shilling or a halfpenny. It often happens in cases of choking that the patient can manage to swallow liquids even when the breathing is distressing and difficult; in such instances emetics—hot water, salt and water, mustard and water, ipecacuanha wine, etc.—can be given with great effect, as the vomiting they cause clears away the offending substance.

### BURNS AND SCALDS.

Injuries caused by excessive heat in one form or another are of common occurrence, particularly in parts of the country where large ironworks, mines, and manufactories of different kinds exist. Injuries produced by flame or hot solid substances are usually called *burns*, whereas injuries caused by hot liquids are generally spoken of as *scalds*.

Burns result from such accidents as explosions of gas and gunpowder, falls into fireplaces and furnaces, contact with hot metal, burning clothes, etc. For the sake of convenience we may also include under burns the injuries caused by strong chemical agents, such, for example, as oil of vitriol, carbolic acid, caustic potash, etc. Scalds occur from such accidents as boiler explosions, contact with boiling water, steam, hot oil, or other heated liquids. When a person is severely scalded or burnt, send at once for medical aid, but proceed to give what assistance you can. In the first place, be very careful how you remove the clothes. Do not

attempt to pull them off, but cut them off with a sharp scissors or knife, so that you can remove them without adding to the sufferings of the patient, and what is more, without pulling off the skin from the injured part with them. If in a severe burn there is a portion of the clothing that sticks tightly to the skin, do not drag it off, but cut it around with your scissors and leave it where it is. It is the custom in this neighbourhood to apply equal parts of linseed oil and lime-water to these injuries; and it is indeed about the best application you can use. This mixture of linseed oil and lime-water goes by the name of *carron oil*, because it was first used at the Carron ironworks. You should soak pieces of linen, lint, or any soft clean rags, into the carron oil, and then cover the burnt or scalded part with them, placing over all a layer of cotton-wool, wadding, or flannel. A quick and ready way is to get a number of sheets of wadding, cover one side with carron oil, and put them on the burnt portions as speedily as possible, securing them by bandages, handkerchiefs, lint, or anything convenient; a number of patients can be dressed very rapidly by this method. If lime-water is not at hand you should use linseed oil by itself, or olive oil, castor oil, almond oil, or *fresh* lard would do. If no oil of any kind is available, you can dust or dredge flour, whitening, or prepared chalk thickly over the injured part, and then cover the whole with wadding in the usual way. Whatever application you make use of, remember that your object is to keep the air from the injured part. If the pain is extremely severe a strong solution of carbonate of soda, lime, or magnesia applied by means of pieces of lint, linen, etc., steeped in it—the whole being encased in wadding in the ordinary way—will sometimes afford great relief.

The inside of the mouth and throat may be dangerously scalded, as when a child sucks at the spout of a kettle full of boiling water, with hoarseness, choking, and danger of suffocation as the result. In such cases, sponges or flannels wrung out of hot water, or other hot moist applications, should be put around the throat, and oil—olive, linseed, etc.—be given the child to drink.

*Burns from strong chemicals*, as oil of vitriol, carbolic acid, aquafortis, spirit of salt, lime, caustic potash or soda, and other similar substances, are caused by such casualties as falls into lime-kilns, explosions in chemical laboratories, and accidents in the various chemical manufactories; they



are sometimes also caused wilfully and maliciously, as when a man throws oil of vitriol into the face of another, or pours it into his ear or mouth as he lies asleep. In these cases you should at once get rid of the obnoxious chemical by bathing the patient with cold water, or if necessary by throwing buckets or basins of water over him, or by putting him in a bath or the nearest pool. If the chemical is an *acid*, then its action is best counteracted by mixing soda or lime, if you can get either of them at once, with the water; but if the injury is caused by some *alkali*, as caustic potash or lime, then the part should be washed with water to which some acid, as vinegar, has been added. After the injured part has been thoroughly cleansed, then it should be dressed with oil in the same manner as other burns.

#### SUNSTROKE AND HEATSTROKE.

When people are exposed for a considerable time either to an intensely hot atmosphere or to the direct powerful rays of the sun (particularly if their clothing is too heavy and worn too tightly, and if they have undergone much fatigue), they are liable to suffer from giddiness, a feeling of sickness, great heat and thirst, and in a short time drop insensible—the skin being hot and dry, the eyes reddened and the pupils contracted, the pulse quick, and the breathing noisy and hurried. Such cases are described as *sunstroke* and *heatstroke*; they occur most frequently in hot climates, and often terminate fatally. If you ever happen to meet with such a case, you should get the patient at once into the nearest shady place, put him into the lying-down position with the head slightly raised, remove all the clothing from the upper part of the body, and dash cold water freely over the face, neck, and chest. On no account give stimulants.

#### FROSTBITE.

When people are exposed to intense cold (more especially if they are exhausted, or the heat of the body is lowered by drinking) they become stiffened, pale, sleepy, and very cold: the extremes of the body, as the fingers, toes, nose,

and ears, get quite numbed, shrunken, and of a pale bluish colour; and this state is followed, if no help arrives, by complete insensibility and death. A patient in this condition should on no account be taken either near a fire or into a warm room. He should first of all be placed in a cold room, and well rubbed with snow, washed with cold water, or placed in a cold bath; afterwards he should by very slow degrees be brought into a warmer atmosphere, and rubbed with dry and warm cloths; and, finally, a little very weak and cold stimulant may be given. But in this country it is generally the local effects of extreme cold, such as numbed and frost-bitten fingers and toes, that we have to deal with. For instance, men who have to handle cold metal, as iron rails, etc., in frosty weather, often get their fingers stiffened, cold, numb, and blue-looking; and should they unthinkingly try to warm their hands at a fire the reaction is so violent that the circulation gets blocked, and mortification of the fingers is the result. Your main object in these cases is to restore the numbed parts to their natural state as gradually as possible; you should keep the patient quite away from any fire or warm room, and rub the affected part with snow, bathe them with cold water, hold them between your own hands, and after a time wrap them in flannel.

### POISONS.

Poisons may be described as substances which, when swallowed, are capable of destroying life. They produce their effects in different ways, and have been arranged in groups or classes by several authorities according to the manner in which they act. It will be quite sufficient for my purpose, however, if you consider all poisons to belong to one or other of two groups, viz. *irritants*, or *narcotics*.\*

By *irritants* I refer to those poisons which irritate and destroy the tissues of the body with which they come into contact. Such are oil of vitriol (sulphuric acid), aquafortis (nitric acid), spirit of salt (hydrochloric acid), carbolic acid,

\* Poisons are often grouped into three classes—irritants, narcotics, and narcotico-irritants, which combine the properties of irritants and narcotics. For the sake of simplicity I divide all poisons into only two classes, one of which you treat *with*, the other *without*, emetics.

lime, caustic potash and soda. These powerful chemical agents burn and destroy the different parts as they touch them; the lips are stained, and the inside of the mouth, throat, gullet, and stomach is more or less corroded and destroyed. As you might expect, these poisons cause intense suffering, a burning sensation in the mouth and throat, and fearful agony in the stomach and belly, with retching and vomiting—blood and shreds of the lining membrane of the stomach often being among the rejected matters.

The other poisons, which you may conveniently group under the title of *narcotics*, since they usually produce more or less stupor, insensibility, or delirium, vary a good deal in their action; thus morphia, laudanum, and opium cause heavy sleep; strychnine brings on convulsions or fits; deadly nightshade (*belladonna*) and henbane induce violent mental excitement and delirium; and alcohol causes intoxication.

In all cases of poisoning send at once for the nearest medical man, and be sure to acquaint him with all the particulars, so that he may bring his stomach pump and anything else that he may think necessary. Do not lose any time yourself, however, but (*unless the poison is an irritant*, as oil of vitriol, etc.), try your best to get the poison out of the patient's stomach by means of emetics, or, in other words, by giving him something to make him sick. You may bring on vomiting by giving a tablespoonful of mustard in a tumbler of warm water, or the same amount of common salt with warm water. If there is any ipecacuanha wine at hand (it is kept by many people as a household remedy) one or two tablespoonfuls mixed with warm water will make a powerful emetic. If the patient is already retching, you may afford much relief and greatly assist vomiting by giving him copious draughts of water as warm as he can drink it. Should a chemist live close at hand you could send for twenty grains of sulphate of zinc, and give it to the patient in warm water. This is an emetic that rarely fails. Tickling the back of the throat with your finger or a feather is another ready mode of causing vomiting, and may prove of great service if you should chance to be far away from any houses, and unable to lay your hand on mustard, salt, or other materials of which to make an emetic.

If the patient is very drowsy, you must use every effort to keep him awake by dashing cold water on his head and face,

giving him strong coffee to drink, and walking him about. If he becomes insensible, try and rouse him by throwing cold water smartly on the face and chest, flicking him with a cold wet towel, and, if the breathing threatens to stop, perform artificial respiration.

In poisoning by *irritants*, such as oil of vitriol, caustic potash, etc., the manner in which you can best give first aid differs from that most suitable for cases of narcotic poisoning. You should *not* give emetics, but should endeavour to save the gullet and stomach as much as possible from the destructive action of the poison by giving soothing drinks, as barley water, milk, flour and water, white of egg, almond oil, linseed oil, castor oil, olive oil, etc. You should also endeavour to counteract the effects of the poison—if it is an *acid*—by giving magnesia, soda, potash, chalk, whiting, plaster from ceilings or walls of rooms, soap suds, or lime, mixed with plenty of water; and if it is an *alkali*, vinegar, acetic acid, or lemon juice, also much diluted with water. The back of the throat and the entrance to the windpipe is often more or less injured in these cases of poisoning by irritants, giving rise to choking, hoarseness, cough, difficulty of breathing, and risk of suffocation. For these distressing symptoms you should apply sponges or flannels, wrung out of hot water, around the throat.

In cases of poisoning you should always, if possible, preserve the vomited matter, also any bottles or vessels of any kind that have contained the poison or suspected liquid, as the medical man will probably wish to examine them, and it may be that evidence in connection with them may have to be given in a court of law. You should, moreover, always endeavour to find out what the particular poison is that the patient has taken. You will generally have no difficulty in recognising a case of irritant poisoning, even if the patient is unable to tell you, by the stains on the clothes, chin, and lips, the burning sensation in the mouth and gullet, the frightful agony in the stomach and belly, the retching and vomiting of blood, shreds of tissue, etc.

BITES FROM RABID AND VENOMOUS ANIMALS;  
AND THE STINGS OF INSECTS.

In this country there are fortunately not many accidents of this kind, but occasionally people are *bitten by mad dogs* and also *by the common viper*.<sup>\*</sup> Rarely, too, we hear of the keepers in menageries being bitten, through carelessness or misfortune, by some foreign serpent which is kept for public exhibition. If you wish to do any good in these emergencies you must act quickly; tie an elastic band, a piece of cord, a handkerchief, or other ligature tightly around the limb *above* the wound—that is, on the side nearest the heart, so as to arrest the circulation and thereby prevent the poison or venom from being carried into the system. After you have made the ligature quite secure, try to get rid of the poison by bathing the wound well with water (*hot* if you can get it), and sucking it. If you have no cracks or abrasions on the lips and in the mouth, you can suck the poison out of the wound with safety to yourself, but it is always better to rinse the mouth well out first with brandy or other strong spirit, if such be available. Of course, in a serious case of this kind (in which the dog is known to be mad, or the snake to be very venomous), medical aid should be sought for *at once*, but you should lose no time in arresting the circulation by applying a ligature above the wound, and then, if the doctor does not arrive immediately, trying to destroy the poison by thoroughly burning the wound with a red-hot wire, knitting-needle, or cinder, a lighted fusee, strong-fuming nitric acid, or, as has been done in India, by placing gun-powder on the wound and firing it. Snake bites are productive of very great depression and faintness, so that ammonia, brandy, or some other powerful stimulant must be administered in these cases. Ammonia is also recommended as an external application. The *stings of insects* are sometimes exceedingly painful, and in some instances are followed by considerable depression and faintness. The first thing is to remove the sting. This, in the case of bees

<sup>\*</sup> It is very different, however, in some of our foreign possessions. For example, in India, in the year 1883, no less than 20,067 deaths occurred from snake bites.

and wasps, can be done by pressing a watch-key firmly down over the sting, which is thereby forced up into the hollow of the key. Ammonia, as sal-volatile, or in any other convenient form, should then be applied to the painful part, and any faintness and constitutional depression should be relieved by the administration of ammonia, brandy and water, wine, or other stimulant.

### FOREIGN BODIES IN THE EYE, EAR, AND NOSE.

*Eye.*—You only increase the pain and irritation by rubbing the eye when bits of sand, grit, etc., find their way into it, and the same remark applies to random and careless attempts to remove the foreign body by means of pins, pieces of wire, and similar articles. It is better to close the eye for a time, when the tears will accumulate, and perhaps wash out the offending substance on to the cheek or the edge of the eyelid. An improvement on this way of proceeding is to hold the face over some sliced onions which cause the eye to “water” so freely that if the irritating particle is not actually imbedded the patient will, as a rule, readily get rid of it. Another plan is to pull the upper eyelid well down over the lower one, two, or three times successively. In this way the lower eyelashes sweep or brush the inner side of the upper eyelid, and in some instances clear away the offending particle. I find it stated that in an iron factory, where accidents of this kind were common, the usual plan was to pull the upper eyelid well down over the lower one and at the same time to close the nostril of the opposite side with the thumb or finger, and to *forcibly blow the nose*; and further, that this method, if the bit of grit was not imbedded and fast, was never known to fail.\* If, however, you do not succeed by these means in getting the foreign body out of the eye, stand behind the patient (who should be sitting down), place a narrow pencil, a probe, piece of wire, a knitting-needle, or a large pin, on the top of the upper eyelid, and, seizing hold of the eyelashes with the finger and thumb of your disengaged hand, turn the lid upwards over the pencil, or whatever it is you have got. The eyelid is thus turned inside out, and the offending piece of

\* *Ambulance Handbook*, J. Ardavon Raye.

dirt, grit, or metal may be readily swept away by a feather, small brush, or a moistened corner of your pocket-handkerchief. If, as occasionally happens, the foreign body is under the lower lid, you can very easily draw the lid down and sweep the offending particle away. Should the foreign body—a bit of steel, iron, flint, or other hard material—be firmly imbedded and fixed in the clear portion of the eye, or, as some say, “in front of (or near) the candle,” drop into the eye a small quantity of sweet oil or castor oil, protect the part by covering it with a folded handkerchief, and seek medical advice. Should mortar or lime get into the eye you ought to wash the eye *at once*, when practicable, thoroughly with a tepid weak mixture of vinegar and water, about two teaspoonfuls of vinegar to three or four tablespoonfuls of water, and carefully get rid of any small fragments from under both upper and lower lids. A little oil should then be dropped into the eye.

*Ear.*—Foreign bodies in the ear may sometimes be got rid of by gentle syringing with tepid water—that is, substances that will not swell, as peas, by such application. Insects can be easily removed by pouring warm oil into the ear—the patient hanging his head towards the opposite side: the insect floats on the oil, and so can be got away. Small particles may be shaken out of the ear by causing the patient to lean his head over on the side in which the foreign body is lodged, and sharply tapping the *opposite* side. Under no circumstances whatever must any attempt be made to remove anything from the ear by means of hair-pins, knife-blades, pins, knitting-needles, or pieces of wire, etc., as *deafness* will likely enough be the result—and perhaps even *death*. If you are unable to achieve your object by the simple means indicated, it is your duty to at once consult your medical attendant.

*Nose.*—Foreign bodies in the nose may be got rid of by causing the patient to sneeze by means of snuff, or by getting him to blow his nose hard at the same time that pressure is applied to the side of the nose in which the passage is clear.

## LECTURE V.

METHODS OF LIFTING AND CARRYING THE SICK OR INJURED:  
AND THE AMBULANCE ARRANGEMENTS NECESSARY IN TIME OF  
WAR.

Giving aid by means of one helper; and the best ways of lifting and carrying by oneself, unaided, an insensible man—Giving aid by means of two helpers; and the methods of making two-handed, three-handed, and four-handed seats—The conveyance of patients on stretchers—Furley's Lowmoor Jacket—The Tibshelf Ambulance Tram—Wheeled stretchers or litters—Improvised stretchers—The conveyance of patients in Ambulance Sick-transport Waggon and Carriages, Country Carts and ordinary Vehicles, Sledges, Horse-litters, Mule-litters, and Mule-chairs—The conveyance of Patients by Rail.—Military Ambulance Organisation.

WHEN you have given all the assistance you can on the spot in a case of accident or sudden illness, you have by no means completed your duty. You have to see that the patient is conveyed safely either to his home, the nearest hospital, the residence of his medical attendant, or it may be to a neighbouring shed or cottage—there to await the arrival of the surgeon. In cases of severe injury—as when a leg or thigh is fractured, or the head, chest, or belly badly wounded—the patient should *always* be carried off in the lying-down position, and for this purpose a stretcher or some other means of conveyance is required. The same remark applies to cases of sudden and serious illness, as apoplectic attacks, and severe continued fainting fits; and also to all cases of accident attended by marked shock, faintness, or troublesome bleeding. In less serious cases, when the injuries are—comparatively speaking—slight, and when more especially they affect the arms, head, or upper part of the trunk, the lying-down position is not absolutely requisite, and such patients may frequently be helped or carried along by their comrades or attendants without the aid of a stretcher or any other sort of conveyance—that is, providing they have only to go a moderate distance.



GIVING AID BY MEANS OF ONE OR TWO HELPERS: AND THE METHODS OF MAKING TWO-HANDED, THREE-HANDED, AND FOUR-HANDED SEATS.

*When there is only One Helper.*—If there is only one person to give assistance, there are several ways in which he may act, according to the state of the patient (whether conscious, unconscious, faint, or helpless), the position and severity of the wound, and other circumstances. Thus (*a*) he may put one arm around the patient's loins at the same time that the patient puts an arm around the helper's neck—the patient's hand resting on the helper's opposite shoulder, and grasped firmly by the helper's disengaged hand. If the injury is in the head, neck, upper part of the body, or lower limb, the patient may also assist himself by means of a stick in the hand farthest from the helper; but if the arm is the part that is wounded, it must of course be properly slung. In this way one helper can give considerable assistance: placing his hip behind the near hip of the injured man, he can not only support him to a certain extent, but can even bear him along. In going down hill, the helper must be particular to hold the patient firmly, as there is risk of him falling or slipping forwards from weakness.

(*b*) If the helper is sufficiently strong, he may carry the patient in his arms like a child; or (*c*) he may carry him on his back—if the thighs are uninjured—holding and supporting the patient's thighs with his arms. These two last methods are useful when the patient cannot stand or walk; in both of them the patient must put his arms around the neck of his bearer. In former times, before stretchers were regularly used, wounded soldiers were generally carried off the battlefield on the backs of their helpers; and Surgeon-General Longmore states it was in this way that the great French surgeon, Baron Percy, carried an officer, dangerously wounded, over a bridge which was being destroyed by the fire of twelve Austrian guns. (*d*) If the patient is unconscious, then the task of his helper is much more arduous. A correspondence on this subject has recently appeared in the columns of the *Lancet* in reply to inquiries made by officers in the Soudan, and also in South Africa,

as to the *best way of carrying by oneself, unaided, an insensible man*.\* One very good plan is that advocated by the chief officer of the Metropolitan Fire Brigade; it is described as follows:—First turn the person face downwards (standing in a line with the patient and facing his head), and take hold close up under each armpit; then raise the body as high as it can be lifted in that position, and allow it to rest on one of the knees; then shift the arms round the waist, and, after interlocking the hands, lift the person in an upright position. After this, take hold of one of the wrists with one hand, and drop into a stooping position; at the same time pass the arm that is free between or around the legs, and the person will then fall across the shoulders; then rise in an upright position, and balance the body on both shoulders.† A somewhat similar method, in which, however, the helper has perfect freedom of one of his arms, is thus described by a correspondent of the *Lancet*.—(e) Turn the individual upon his face, with the arms extended in a line with the body. Raise the trunk until he be in a kneeling position. Place yourself under him, so that his stomach rests on your right shoulder. Pass your right arm between the thighs and behind his right thigh. With your left arm draw his left hand forwards under your left, and grasp the wrist with your right hand; then raise yourself to an erect position. If you can obtain assistance in this operation, so much the better; or if there be a bed or table upon which the subject may be placed, he will be more easily raised, or, rather, you will more easily raise yourself and burden. By this method the weight falls directly on your shoulders. The person carried cannot slip forwards, as you have his hand grasped from behind; nor can he slip backwards or off the shoulder, as your arm is over the thigh. The left arm is disengaged. Or, by reversing the operation, he may be carried on the left shoulder, in which case the left arm is passed behind his left thigh and his right hand grasped from behind. Your right arm is then free. This is very advantageous; as, for example, going down a ladder from an upper storey of a burning building where the rescued one is overcome by smoke, or where the operator wishes to carry weapons, etc., off the field of battle.‡

\* *Lancet*, March 14, 21, and 28, 1885.

† *Fire Protection*, Captain Eyre M. Shaw.

‡ “How to carry, unaided, an insensible man,” Beaver, *Lancet*, March 28, 1885.

If straps, bands, scarfs, or other materials suitable for slinging or tying, are available, other methods may be adopted. Thus the correspondent alluded to above, writes—(f) Seat the subject with the legs bent on the thighs, and these bent on the trunk; the head will then rest on the knees. Pass a broad continuous strap (a soldier's belt for example) behind the thighs at the popliteal spaces (that is, behind the back of the knees) and under his arms. Crouch down behind him, back to back, pass the strap over your forehead, and raise yourself. The strap should be short enough to allow the weight to fall upon the shoulders and upper part of your back while you are bent slightly forwards. The head may drop backwards: but if so, it falls on the top of yours. The strap, being under his arms, prevents him from falling through. Both your arms comparatively free.

*When there are Two Helpers.*—(a) Two helpers may carry a



FIG. 36.—Two bearers carrying a patient, in a sitting-up position, on a two-handed seat.

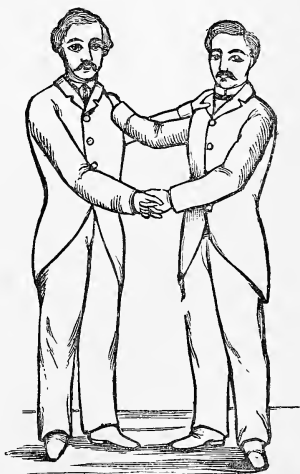


FIG. 37.—Plan by which two bearers may carry a patient, in a lying-jack position, on a two-handed seat.

patient by joining two of their hands under his thighs, and clasping him around the loins with their disengaged arms. The patient is thus carried in a sitting position (Fig. 36), and

may further support himself by putting one or both of his arms around the necks of his helpers—that is, supposing from the nature of his injuries he is able to do so. This method acts well for a short distance; but the helpers cannot long bear the severe strain thrown on the arms and joined hands which support the thighs and sustain the entire weight of the patient.

(b) A patient may be carried in a lying-back position by the helpers joining two of their hands tightly under his thighs, and placing their other hands on—and grasping firmly—each other's shoulders (Fig. 37). This is an excellent method for carrying patients who are very weak, absolutely helpless, or injured in both arms; and in this way,

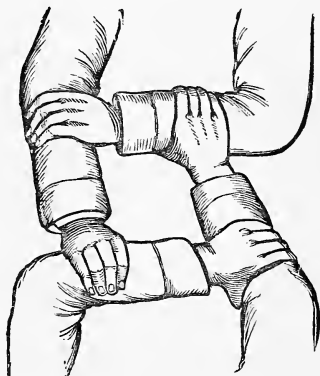


FIG. 38.—Four-handed seat, made with the arms uncrossed; sometimes called the sedan-chair or dandy-chair.

as the weight of the body does not fall entirely on one pair of arms (as in the former method), but is pretty equally distributed on all the arms, and to some extent on the chests and shoulders, of the helpers, a wounded man can be conveyed for a considerable distance without extra fatigue to his bearers.

(c) The helpers, by crossing their arms and then taking hold of each other's hands, can form a four-handed seat on which to carry a patient—that is, if he is in a fit state to be conveyed in the sitting-up position, and also able to support himself by putting his arms around the necks of his

bearers. A good seat can certainly be made in this way; but a great disadvantage is that the weight of the patient quickly tells upon the bearers' arms at the points where they cross each other, and so rapidly causes severe pain.

(d) When it is decided to use a four-handed seat for any particular case, it is better, therefore, to make one with *uncrossed* arms. This form of seat is that known as the "sedan-chair" or the "dandy-chair," and, though it looks a little complicated (Fig. 38), can easily be made as follows:—Let the two bearers stand face to face, each grasping the middle of his right fore-arm with his left hand, the backs of the hands upward; then let each bearer grasp the middle of the other's left fore-arm with his right hand, the *backs* of the



FIG. 39.—Two bearers carrying a patient on a four-handed seat.

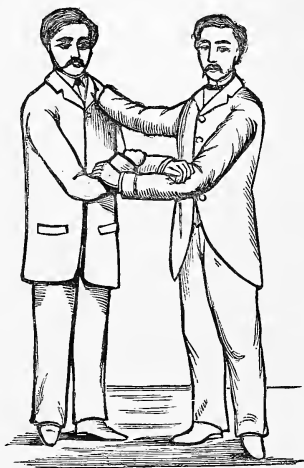


FIG. 40.—Three-handed seat and back support.

hands—I repeat—*upwards*, and the chair is complete. A four-handed seat made in this way is comfortable and also secure, providing that the patient can further support and steady himself by putting his arms around the necks of his helpers (Fig. 39). The weight of the patient, too, by this arrangement of the bearers' arms, can easily be borne.

(e) Perhaps the most useful method of all—because it is the easiest for the bearers as well as the most suitable for the

greater number of injured men, who are generally weak, but not utterly helpless—is that known as the *three-handed seat and back support* (Fig. 40). This method, like the former one, looks rather complicated, but can easily be managed as follows:—Let one bearer grasp his left fore-arm with his right hand, and the other bearer's left fore-arm with his left hand at the same time that the other bearer grasps his right fore-arm with his (the other bearer's) left hand, and places his (the other bearer's) right hand on his left shoulder. By this method the patient is provided with a comfortable, firm, triangular seat, as well as with a cross support behind, which prevents him falling backwards; and the bearers can sustain the weight of the patient with greater ease to themselves, as well as much more comfortably and for a longer distance, because their bodies face rather more to the front.

There may be some difficulty in getting a feeble or badly injured patient on to these different hand-seats; but it can be managed by the bearers placing themselves one on each side of the patient, kneeling on one knee, and then raising the patient on to *their* knees, so that he can support himself by putting his arms around his helper's necks while they quickly join their hands into a seat underneath him. The bearers, having locked their hands securely, can then slowly rise up together, lifting the injured man with them. If one of the lower limbs is badly hurt, for instance broken (*and no stretcher being available*), then a *third helper is absolutely necessary*; splints should be bound on to the injured part; the legs should be tied together, and raised carefully in a horizontal position by the third bearer as the patient is being lifted; and as the party moves off, the third bearer—holding the patient's legs securely and steadily in the horizontal position—walks in front.

(f) An *insensible* patient may be conveyed by two bearers—one walking in front carrying a leg under each arm, the other walking behind supporting the upper part of the body; both bearers being careful to get a secure hold (the hindmost one by passing his arms under the shoulders and around the chest of the patient) before rising steadily together.

Instead of employing any of these methods the bearers may sometimes *improvise a seat* by carrying horizontally between themselves a pole, rifle, a piece of light planking, a bar of a gate, or anything else suitable and handy, around which something soft has been rolled, as a blanket, rug, overcoat, or

tunic. The patient sits on the seat thus formed, and further secures himself, if he is able, by placing his arms on the shoulders of his bearers. If the patient is very helpless, the improvised seat should be placed close to his side or back; and the bearers, after carefully lifting him on to it, should rise up (lifting the seat) slowly together; and if any straps, belts, or accoutrements are available, the bearers can use them as shoulder straps with which to sling the seat, and then their hands are free to lend additional support to the patient.

Patients whose injuries are comparatively slight (more particularly if it is the upper part of the body that is wounded—the arms, head, face, or upper portion of the trunk; or the foot) may be conveniently carried by one or other of the methods described. But when the joints are injured, or the bones fractured, of the lower limbs; or when there are severe wounds of the head, chest, or belly; or serious injury of the shoulder joint; or when there is much shock, faintness, or tendency to bleed; and indeed when the injuries are *severe*, or whenever the case is one of grave and sudden illness, such as apoplexy—then the patient should be carried in the *lying-down position* by means of *stretchers* or other suitable conveyances.

#### METHODS OF LIFTING AND CARRYING THE SICK OR INJURED ON STRETCHERS.

A *stretcher* may be described as a light and strong frame of an oblong shape (provided with handles), on which a canvas is stretched tightly so as to afford a comfortable and elastic support to anyone lying upon it. I cannot enumerate, far less describe, all the various stretchers that have been constructed, from time to time, by different inventors; it will be sufficient for my purpose to notice two very good ones—the *regulation stretcher* of the British Army; and the *folding stretcher*, “*Furley*” pattern, which is supplied by the Ambulance Association.

The Regulation Stretcher is made of a piece of canvas, 6 feet 6 inches long, 1 foot 11 inches wide, nailed to two side

poles, 7 feet  $9\frac{1}{2}$  inches long, with two hinged steel cross-pieces; it is also provided with four foot-pieces, to which small rollers are attached, so that when laid down it is raised by means of its foot-pieces about 6 inches from the surface on which it rests (which prevents the patient being exposed to wet underneath, or to pressure from stones or rough ground); and, moreover, when required, it can be readily pushed along its rollers into a waggon, cart, or other conveyance having a level floor. All the parts of the stretcher are connected one with the other, so that no portion can possibly be lost; and the whole concern, which weighs (Surg.-Major Evatt says) 32 lbs., can be folded up, when not in use, for storage or packing. The stretcher also has shoulder straps in the form of leather slings attached, one at each end, so that it can be borne without the strain on the hands, and—what is more important—without the danger of dropping down from the careless conduct of the bearers.

The “Furley” Stretcher, with which you are supplied, is provided with four foot-pieces and with shoulder straps, and—like the military stretcher—possesses the great advantage of having no independent parts; you can—if you wish it—raise the canvas up at the end of the frame in such a way as to give head support; the joints are so arranged that if the stretcher has to be passed into a carriage or through a doorway rather less than two feet in width, the bearers can diminish the breadth without inconvenience to the patient upon it; it can be procured either with *fixed* or *telescopic* handles, the great advantage of telescopic handles being that—with them—the stretcher can be used more easily in mines where the space is limited, and can also be placed in railway carriages and other vehicles not otherwise sufficiently long to receive it; it can be readily folded up, when not in use, so as to occupy but little room; it weighs only 22 lbs.; and, lastly, it is cheap, costing no more than two guineas with fixed handles, and two pounds, ten shillings, with telescopic handles.

Now, you are possessed of a capital stretcher; but that is not all that is required for the proper and safe removal of a sick or injured man. Everything depends upon your own behaviour and steadiness. You must use the utmost care and gentleness when lifting the patient from the spot where he lies on to the stretcher. When raising and marching with the stretcher, you must not relax any of your caution,



but must move strictly according to the rules which I shall presently explain to you ; and lastly, when you reach your destination you must continue to exert the greatest patience, care, and gentleness, in removing the patient from the stretcher to his bed. Any carelessness, rough handling, or want of attention to the proper rules on your part, will cause increase of the patient's sufferings, aggravation of his injuries, and perhaps even danger to his life.

Before beginning your work always see that you have "plenty of help." If possible, never have less than three men to remove a patient, for a third man is absolutely necessary if the patient is perfectly helpless, in cases of fractured thigh or leg, if one of the other bearers gets wearied or "done," or (as may happen in military work) one of the men should be wounded.

The three men chosen should be distinguished from each other by being numbered—No. 1, No. 2, and No. 3. The strongest man of the three should be selected for No. 1, as he will have to bear the greatest weight. In order that the little party may act regularly, steadily, and move easily together, one of them should superintend the work and give the necessary directions by simple words of command. This duty is best performed by No. 3, as, from his position, he can see the other two bearers as well as the patient.

At the word *Place the stretcher*,\* then, from No. 3, No. 1 takes the head of the stretcher and No. 2 the foot, and they place it in a line with the patient's body, the foot of the stretcher being next the head of the patient. The stretcher is placed close to the patient so that he need not be moved by hand farther than is absolutely necessary ; and it is put in a line with the patient's body, as if placed cross-wise the bearers would have to turn round, and would be liable to stumble when moving him. Again, if the stretcher is placed by the side of the patient, it interferes with the movements of the bearers, and is liable to make them stumble when placing the patient on it.

No. 3 (after satisfying himself that the patient has received all the *immediate* assistance which it is possible to render him on the spot, and after arranging cushions or folded articles of clothing, etc., on the stretcher, so as to give any support to the injured part that may be necessary)

\* *Stretcher Exercise*, No. 1, St. John Ambulance Association.

gives the word *Fall in*. At this order No. 1 places himself on the right and No. 2 on the left side of the patient—the two bearers facing each other—and No. 3 places himself on the injured side in a line with the patient's knees, his business being to look after the injured part, to see the dressings, etc., do not get displaced, and also that No. 2 does not interfere with or touch the patient's feet when lifting or carrying the stretcher.

At the word *Ready* Nos. 1 and 2 go down on one knee, grasping each other's hands under the shoulders and upper part of the thighs of the patient, while No. 3 places his hands underneath the lower limbs, always taking care, in case of an injury, to have one hand on each side of the seat of injury.

At the word *Lift* the bearers rise together, slowly and carefully, keeping the patient in a horizontal position.

At *March* all the bearers take short side paces until the patient's head is over the pillow of the stretcher.

At *Halt* the bearers stand still.

At *Lower* the patient is placed gently on the stretcher, and the bearers then stand up.

Care must now be taken that the patient rests securely on the stretcher in the particular posture which is most suitable to the nature and position of his injury; and that the injured part (and other portions of the body, if necessary) are properly supported by pillows, folded clothes, accoutrements, hay, straw, or other materials. All being arranged properly and comfortably, the word *Fall in* is given and No. 1 places himself at the head of the stretcher with his face towards the patient, No. 2 at the foot with his back to the patient, and No. 3 at the side of the patient.

At *Ready* Nos. 1 and 2 stoop down and grasp the handles of the stretcher, having previously adjusted their shoulder-straps in case they are used.

At *Lift* the stretcher is gently raised to position ready for moving off.

Remember that the bearers must always carry the stretcher with their hands, or by means of their shoulder-straps. On no account must they ever carry it on their shoulders, for under such circumstances the patient might faint, bleed, and even die without being noticed, or he might fall off and have his injuries greatly aggravated thereby. It is stated that the American general, Stonewall Jackson, was being carried on

a stretcher supported on the shoulders of four bearers, when one of the bearers was shot and fell, and the sudden fall of the general from such a height so aggravated his injuries that he died in consequence.\* In military work, the plan of carrying stretchers on the shoulders of the bearers is attended by other and peculiar risks. Thus I find it recorded that in the Crimean War a wounded officer on one occasion was being carried on a stretcher which was supported on the shoulders of the bearers—who had their rifles slung across their shoulders, muzzles uppermost—when one of the rifles accidentally “went off,” and the officer was shot dead.† Moreover, when a stretcher is carried on the shoulders, the patient is rendered nervous and uneasy because of the height at which he is placed, and as the bearers are scarcely ever the same size, it is impossible in this way to carry the stretcher in a perfectly horizontal position. It is better, however, if it can be managed, always to have the bearers as nearly alike in size and strength as possible, as they can more easily keep the stretcher level, and can work more evenly and regularly together; and if shoulder-straps are used, their length must be carefully regulated before starting, so that the parts supporting the stretcher may all be at equal distances from the surface of the ground. When the bearers are ready to make a start, No. 3 gives the word *March*.

At this order the bearers move off with the patient, but they must not step off with the same foot; thus, if No. 1 steps off with the left foot, No. 2 leads off with the right, and *vice versâ*. The object of walking out of step is to keep the stretcher from rolling first on one side and then on the other. If the bearers moved in step, each time they both advanced their right feet their bodies would also dip together with the stretcher somewhat in the same direction, and when their left feet advanced the dip would be on the left side. By marching out of step—or, as it is sometimes termed, with a “broken step”—the stretcher is kept level, and there is no tendency to roll. Moreover, the bearers must not step out as in ordinary walking or marching, but on the contrary they should take short steps of about twenty inches, and should move steadily and without any spring. The feet, as they

\* *Gunshot Injuries*, Surgeon-General Longmore.

† *Ambulance Handbook*, J. Ardavon Raye.

are advanced, should not be raised farther off the ground than is necessary to clear stones, inequalities of the surface, or other obstacles, and should be planted firmly down without any jerking motion. The hips should be moved as little as possible, and the knees should be rather bent. In fact, the bearers when marching should imitate as closely as possible the walk of those persons who, in pursuit of their business, have to carry fragile articles and liquids—as eggs, crockery, plaster of Paris images, milk, water, etc.—on their heads. Their object is, of course, to cause as little movement of the body as possible, and so lessen the up and down motion of the stretcher during its carriage. Another advantage of taking short steps is that the bearers thereby avoid knocking one or other of their thighs against the transverses or crossbars of the stretcher. They are apt to constantly do this if they take long paces, hurting themselves, and, what is worse, jolting the stretcher. The bearers should also endeavour to take their steps equal in length one with the other, as, if one bearer is continually over-stepping the other, jolting of the stretcher is the inevitable result. However irregular the ground is, the bearers should endeavour to keep the stretcher as level as possible. When the ground is moderately level the patient should be carried so that he faces the direction in which he is being moved. If the patient is being carried uphill his head should be in front, if downhill his head should be behind—except in cases of fracture of the thigh and leg, when, in going uphill, the head should be behind, and in going downhill before, so that the weight of the body may not tend to displace the fracture. Never attempt to carry a stretcher over fences, hedges, or walls, but either forcibly break down the hedge or wall so as to make an opening for the stretcher, or carry the patient to where there is a gate or gap through which the stretcher may be got. If a broad ditch or hollow has to be crossed the stretcher should be laid down near the edge; the foremost bearer should then get into the ditch and support the front of the stretcher (pushed forward by the other bearer), the hinder end of the stretcher resting on the edge; the second bearer should next get into the ditch, and the stretcher after being carried across should have its fore part put to rest on the farther edge, while its hinder end is supported by the second bearer. The first bearer then gets out of the ditch, and the stretcher being pushed or lifted on

to the level ground, remains there until the second bearer gets up. The bearers then raise the stretcher and move on. When the patient has been conveyed to his destination No. 3 gives the word *Halt*, and the bearers thereupon stop—but not too abruptly, so as to avoid jerking the patient—and stand still.

At *Lower* the bearers gently place the stretcher on the ground and then stand up.

At *Unload Stretcher—Ready*, Nos. 1 and 2 sink down on one knee and grasp each others hands under the shoulders and upper part of the thighs of the patient, and No. 3 places his hands underneath the lower limbs, taking care, in case of a fracture, to have one hand on each side of the seat of injury.

At *Lift* the bearers carefully raise the patient up.

At *Lower* they lay him gently on the bed, couch, or wherever it has been arranged to place him.

Such is the way in which you would usually transport a sick or injured patient on a stretcher. It may happen, however, that a man is hurt or taken suddenly ill in a spot where there is very little room, and where there is not space sufficient to allow of the stretcher being placed in a line with the patient's body. In such an emergency you would have to place the stretcher at the side of the patient, and you would proceed somewhat as follows—*supposing there were four bearers available*. The bearers should number off, 1, 2, 3, 4; and No. 4 gives the word of command.

At the order *Fall in*\* No. 1 places himself by the patient's shoulders, No. 2 by the middle of his body, and No. 3 by his feet, all three standing on one side of the patient—*on the injured side*.† At the same time No. 4 places the stretcher on the ground by the other side of the patient, and remains standing near its centre facing the other bearers.

At *Ready*, Nos. 1, 2, and 3 stoop down and kneel on the left knee if they are on the left side of the patient, on the right knee if they are on the right side of the patient. They then proceed to take hold of the patient; No. 1 passing one of his arms beneath the patient's neck and the other under his shoulder-blades; No. 2 passing both arms round the middle of the body, one above, the other below the buttocks; and No. 3 passing both arms under the lower

\* *Stretcher Exercise*, No. 2, St. John Ambulance Association.

† See Appendix. Rules for "Lifting and Carrying on Stretchers."\*

extremities, excepting in case of fracture, when he must place one hand on each side of the broken bone, so as to steady it. At the same time No. 4 grasps the nearest pole of the stretcher with his left hand, and the pole farthest from him with his right hand, near the centre.

At *Lift* Nos. 1, 2, and 3 gently raise the patient up, each at the same time placing on the knee which is not touching the ground his elbow of the same side. While the patient is thus being raised No. 4 moves the stretcher into proper position under him, and kneels down on one knee by its side.

At *Lower* Nos. 1, 2, and 3 carefully lower the patient down to the stretcher, while No. 4 at the same time assists in supporting and placing him on it.

At *Stand to stretcher* No. 1 goes to the head of the stretcher with his face towards the patient, No. 2 to the foot with his back to the patient, and Nos. 3 and 4 remain in position on each side of the stretcher. The bearers proceed then, in the same way as described previously, to lift the stretcher and move off, acting by similar words of command—*Ready, Lift, March*, etc.

It may happen that the space is insufficient for the stretcher to be placed in a line with the patient, and also that *only three bearers are available*. In such a case the bearers are numbered No. 1, No. 2, No. 3; and No. 3 takes charge of the party.

At the word *Place stretcher*\* No. 1 places the stretcher on the ground close to the sound side of the patient.

At *Fall in* the three bearers place themselves on the injured side of the patient in the same positions as described in the last exercise.

At the words *Ready* and *Lift* the bearers act as in the previous exercise.

At *Lower* the bearers lean forward so as to carry the patient over the stretcher, and then carefully lower him down upon it.

At *Stand to stretcher* No. 1 goes to the head of the stretcher, No. 2 to the foot, and No. 3 remains at the side of the stretcher.

Then follow the orders *Ready, Lift, March*, etc., as previously described. In mines, underground workings of different kinds, narrow passages and cuttings, there may be

\* *Stretcher Exercise*, No. 3, St. John Ambulance Association.

only space sufficient for two men to be engaged in giving first aid and managing the removal of a patient on a stretcher.

In such a dilemma the stretcher should be placed by the two men,\* No. 1 and No. 2, in a line with the patient's body, the foot of the stretcher being, if possible, close to his head. It is not advisable, however, to be too particular as to the head or foot of a stretcher in a mine, as it would probably be quite impossible to reverse it, and the bearers can always lower the pillow.

No. 1 gives the word *Ready*, when both the bearers get into position as follows:—No. 1 places his feet one on each side of the patient between his body and arms, the toe of each foot as near the armpits as possible, standing over the man. He then stoops down and passes his hands between the sides of the chest and arms underneath the shoulders, and locks the fingers. If the patient's arms be uninjured he may put them round the neck of No. 1, and by this means greatly assist him in lifting. No. 2 at the same time places his right foot between the calves of the injured man's legs, as close to the knees as possible, and his left foot at the injured man's right side, close to the crest of the hip (when the patient's legs are in splints and tied together, the feet of No. 2 must necessarily be placed outside); he then kneels down and passes his arms round the outside of the patient's thighs at the lowest part, and locks his fingers behind just at the bend of the knees.

When both bearers are ready No. 1 gives the word, *Lift and move forward*. The patient is then slowly lifted, just sufficient to allow his body to clear the stretcher, both bearers slowly and gradually moving forward, No. 1 by very short steps, and No. 2 by bending his body forward over his left thigh, by which means he exercises a pushing movement which very greatly assists No. 1. No. 2, when he has bent his body forward as much as he can without moving his feet, advances his right foot to his left, then again advances his left foot and bends his body forward, this movement being repeated until the patient is laid on the stretcher.

The bearers will then act in the ordinary manner as far as the nature of the locality will permit.

The four different methods that I have given you of conveying sick and injured patients on stretchers are those framed

\* *Stretcher Exercise*, No. 4, St. John Ambulance Association.

and recommended by the Ambulance Association, and they are drawn up and arranged so that one or other of them may be usefully adopted in almost any circumstances under which an accident or sudden attack of illness may occur. Thus, when you have plenty of space at your disposal, the first exercise is practicable. When there is not space enough for the stretcher to be placed in a line with the patient, as in a small room or a crowded work-shed of some description, the second or third exercise, according to the number of bearers available, will be found suitable; and in the case of narrow cuttings, tunnellings, and narrow ways in crowded manufactories, the fourth exercise will be found the most serviceable.

The stretchers supplied by the Ambulance Association, when required for use in mines, are provided with telescopic handles, so that a patient can be placed on the stretcher down in the workings, and brought up the shaft in a horizontal position without being further disturbed. I understand that this can be done in well-constructed and roomy mines. There are, however, some mine shafts, borings, sewers, and other narrow places, up which it is impossible to bring a patient in the horizontal position, owing to the deficiency of lateral space. Now, to meet such emergencies an apparatus has been designed by Mr. John Furley, by which a patient can be drawn safely up, *in the vertical position*, through a narrow shaft, even with a fractured thigh. It is known as *Furley's Lowmoor Jacket*, as it was originally designed for use in the small pits at Lowmoor, near Bradford. It can be used with any ordinary stretcher, having fixed handles, and is described by Surgeon-Major Evatt\* as follows:—"A jacket which encircles the injured person's chest and abdomen, and which has strong back pieces which run up behind the patient's back, and cross over an iron bar, which is slipped by iron rings over the handles of the stretcher. There is also a strong support passing between the legs and fastening to the jacket. The legs are kept in their place by a strap, and additional support is given by a web-stirrup into which the sound foot can be slipped if desired. The patient can thus be drawn vertically out of the mine or sewer, or lowered into a boat, without injury to the wounded part."

I am not aware that the Lowmoor jacket has ever been

\* *Ambulance Organization, Equipment and Transport*, Surgeon-Major Evatt, M.D.



actually used for the particular purpose for which it was designed; viz., the raising of injured men, in a vertical position, safely up a narrow pit-shaft: but, in reply to my enquiries on the subject, Mr. Smyth, the Manager of the Lowmoor Iron Works, very kindly wrote to me, and said that he had every confidence in the jacket, and believed it to be admirably adapted to the purpose for which it was intended, as he had proved it by experiments. Moreover, the Lowmoor jacket, attached to an ordinary stretcher, proves of the greatest service under a variety of circumstances other than those which it was especially designed to meet: thus, Mr. John Furley writes:—"Within the last few days we have had to employ the jacket on a steep and narrow London staircase. The patient had a bullet wound in the thigh and could not be seated. The jacket was designed for use in mines, sewers, etc.; but it has happened more than once that we have been obliged to use it when removing an injured person through the first floor window of a cottage, where other means were impossible." Several other appliances have been designed for raising or lowering of injured men through narrow passages, as sewers, the hatchways of a ship, or the shafts of a mine: but the Lowmoor jacket, attached to an ordinary stretcher, seems adapted to meet the requirements of any case; moreover it is simple, easily applied, and cheap (the price of the jacket, including bar to attach to stretcher, being only one pound, five shillings); and, lastly, the patient is fixedly maintained, no matter in what direction he may be moved, in the flat lying-down position.

I now pass on to refer to a method of *conveying the sick or injured along underground workings* which has not as yet attracted the attention it deserves. I allude to the *Tibshelf Ambulance Tram*, which was arranged by the chairman and members of the Tibshelf Centre of the Ambulance Association, and which I believe only requires to be generally understood throughout the various large mining districts for it to be greatly appreciated and extensively adopted.

Mr. S. C. Wardell, of the Babbington Coal Company, Nottingham, chairman of the Tibshelf Centre, has, with the greatest courtesy, favoured me with very complete information concerning the ambulance tram—indeed, his description is so complete and lucid, that I cannot do better than give it in his own words. It is as follows:—"The tram we have designed is like our ordinary pit-trams in size and shape,

except that it has no end boards, both ends being open. In the case of an accident, when a stretcher is not used, we made arrangements for a head-rest to be fixed up at one end of the tram at an angle of 60 or 70 degrees, so that the patient may sit in the tram, with a comfortable support for his back and head. In this way he may be wheeled along the underground road to the shaft bottom, and be drawn up the shaft in the tram. To be prepared for a more serious accident underground, I caused to be fixed to a Furley stretcher with telescopic handles four legs, seven or eight inches long, each leg having a spiral spring around it. These legs fit into four holes bored in the bottom of the tram, but the spiral springs catch in the bottom of the tram, and, of course, give way at any jolt of the truck. At our Tibshelf Colliery this stretcher may be laid in the bottom of the tram and drawn up the shaft, the position of the patient thus not being altered between the place of the accident in the pit and his home.

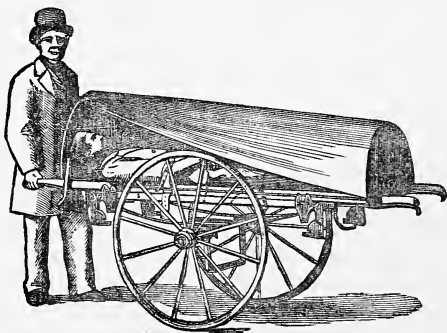


FIG. 41.—The Ashford Litter.

“The tram without the stretcher could be used at any colliery. The use of the stretcher as well would depend on the width of the shaft or length of the ‘cage’ or ‘chair.’

“The tram is four feet long and three feet wide, and will only hold one person.

“It can only be used underground or where tramways are laid on the surface.

“It was designed for the conveyance of injured men underground.”

Such is the ambulance tram, of which Mr. Wardell—after considerable experience of its use—remarks:—It is a “complete success, answering its purpose in every way. I do not see that, for conveying injured men underground, it can be improved.”

*Wheeled stretchers or litters* (Figs. 41 and 42), in towns and districts where the roads are good and suitable for wheeled conveyances, afford a quicker, less fatiguing, and altogether better means of transporting sick and injured patients, than ordinary hand-stretchers. A wheeled stretcher or litter consists of two distinct parts—a *stretcher*, such as has already been described, and a *wheeled support*. There are many different appliances of this kind in use; but I can only briefly allude here to two varieties. The *military wheeled stretcher* with which our army is provided; and the *Ashford litter*, which is supplied by the Ambulance Association. In the first named, the *stretcher* is the “regulation stretcher,” which I have already described; and the *wheeled support* (made of steel and iron throughout) “consists of an axle tree, a pair of wheels (three feet in diameter), a pair of elliptical steel springs, with crutches on their upper surfaces to receive the stretcher poles, and a pair of folding legs. . . . The height of a stretcher when placed on the support is 2 feet 7½ inches. . . . The whole is made to take to pieces and to pack up in a small space for stowage. . . . As bearers must be trained in order to carry patients on hand-stretchers properly, so they have to be instructed in quickly unpacking and putting together the stretcher support, and in using it in connection with the stretcher when a wounded man is to be conveyed by it, or to be transferred from it to an ambulance wagon.”\*

In the Ashford litter (Figs. 41 and 42) the *stretcher* is that which I have already described as of the “Furley” pattern; the *wheeled support* consists of an under carriage of two wheels, on elliptical springs; and one great advantage of this vehicle is that the bearers can pass with the stretcher *between the wheels and over a crank axle, and thus lifting over the wheels is avoided*. When it is desired to move a patient he is placed in the usual way on the stretcher, which is *detached* from the wheeled support and laid either *on the ground or on a table*; the stretcher with its burden is then fixed on its wheeled

\* *Gunshot Injuries*, Surgeon-General Longmore.

support (by the bearers *passing between the wheels*, and *not* lifting the stretcher over the wheels), and the whole contrivance can, always providing the roads are moderately good, be rapidly drawn or pushed along by a single bearer, *care being taken to keep the litter in a horizontal position, and not to wheel it like a barrow*. On arriving at the patient's home, the hospital, or other destination, the bearers remove the stretcher and patient from the under-carriage, *passing between the wheels of the support*. The stretcher is finally placed on the ground, floor, or a table, and the patient is lifted off in the usual way and laid on his bed: or the stretcher, with the patient on it, is removed from the wheeled support to be properly fixed—it may be—in a specially-built horse ambulance carriage.

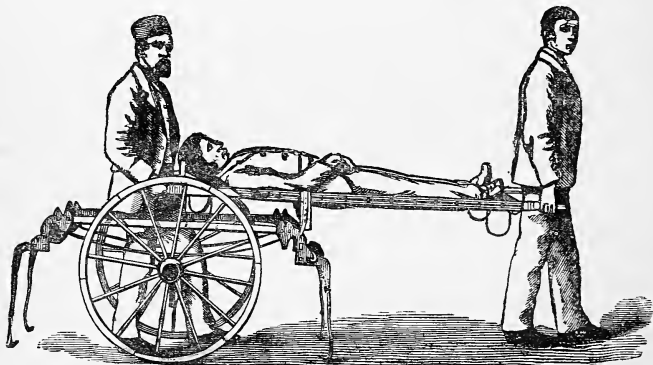


FIG. 42.—The Ashford Litter; with stretcher detached.

The great advantages of these hand-wheel litters are the *rapidity* with which the patient can be conveyed from place to place, the *ease* with which the conveyance can be moved, and the fact that *one man only* is required to push or drag the litter along. It is stated by Surgeon-General Longmore that one man with a wheeled stretcher can do as much work in a given time as four men with ordinary hand stretchers. You may understand, therefore, what a saving of valuable time, fatigue, and labour may be effected by the use of hand-wheel litters in preference to the ordinary stretchers.

Coming to the question of expense, the Ambulance Association supplies the Ashford litter complete for eleven pounds, or, with telescopic handles to the stretcher, for eleven pounds,

ten shillings; and once procured, a wheeled litter only requires a little cleaning and occasional repainting, and if looked after with ordinary attention and kept in a suitable shed, it will last for an indefinite period, and be always ready for immediate use.

Wheeled stretchers were practically tried in the Schleswig-Holstein War of 1864, the German War of 1866, and in the great Franco-German War of 1870-71, and they were found to be of great service in parts where the roads were good, and more adapted therefore for work in connection with stationary hospitals and garrisons. On the battlefield itself, however, and in its immediate neighbourhood, they were found not so suitable on account of the rough and broken character of the ground over which the troops manœuvred. Such conveyances have been found to answer admirably in the streets of our towns and cities, and also in rural districts, in connection with collieries and large manufactories, where the roads are moderately good and suitable for wheeled transport. Consider, for example, the Ambulance Organization established at Brighouse, Yorkshire, the rules and particulars of which have been most kindly afforded me by the late Hon. Secretary, Mr. Henry Y. Barber. Brighouse, Mr. Barber tells me, is a thickly populated manufacturing district, with coal mines and other works in the immediate neighbourhood; consequently there are many serious accidents, and the nearest infirmary is four miles off. A Horse Ambulance Carriage, capable of holding four patients, is used for the purpose of taking the injured to the hospital: but the Ashford Litters, of which there are several, act as feeders, and the patients are brought on them to the larger conveyance where the roads, etc., will not admit of it being brought directly to the scene of the accident. The Ashford Litters are placed in different parts of the district; the stretchers being fitted with telescopic handles so as to admit of their use in Infirmary hoists. When once a patient is placed on a stretcher, he is never removed therefrom until he is conveyed either to his own bed at home, or to one or other of the Infirmaries at Halifax, Huddersfield, or Bradford, the stretchers fitting into the Horse Ambulance carriage.

Now that you have some idea of the different methods of helping along or carrying the sick or injured, you should on no account rest satisfied with mere theoretical knowledge, but should frequently go through the various methods of

transporting patients amongst yourselves. When you meet together for practice you should ask a comrade to represent an injured man, and then see how well you can give him aid by means of one helper and two helpers, and by supporting him on two-handed, three-handed, and four-handed seats. Above all, you should constantly practise lifting him on to the stretcher, carrying the stretcher, and lifting him off the stretcher, carefully going through each of the four stretcher exercises framed and recommended by the Ambulance Association. When you have an opportunity, you should also practise carrying a stretcher—with a friend lying on it—uphill and downhill, over rough and broken ground, across ditches, and other obstacles. It is only by regular and careful practice that you can attain proficiency in transporting patients, and go through the stretcher and other exercises with the care, skill, and gentleness, which are so necessary in removing any one really ill or badly hurt.

For the purposes of practice you have the stretcher sent to you by the Association; and if such stretchers (or, where the roads are suitable, wheeled stretchers) were kept in a convenient spot at all the various collieries and other works in the district, they would prove of the greatest possible service in case of accidents. It may happen, however, that no properly-made stretcher—just at the time when it is most sorely needed—is at hand; or there may be only one stretcher available, and several men badly hurt and urgently requiring removal. During military campaigns the want of stretchers has often been terribly felt in the presence of enormous numbers of severely-wounded troops. In such emergencies you should always be prepared to *improvise stretchers*—that is, to make temporary stretchers out of any materials that chance to be near at hand and suitable for the purpose. Shutters, doors, boards, short ladders, window-frames, bed-frames, or benches, will serve as stretchers at a push; but they should be covered with something soft, as hay, straw, rushes, cushions, blankets, or clothes. Blankets, overcoats, rugs, counterpanes, curtains, or pieces of cloth or canvas—if nothing else is available—may be used, the four corners being held and carried by four bearers. Soldiers wounded in the trenches before Sebastopol were sometimes thus removed on the blankets with which they were supplied. The silk sashes of the officers—as formerly made—were also utilised in the same way. This plan should, however, only be

adopted when no other means of extemporising stretchers are at hand, and it is necessary to remove the patient immediately; it is very fatiguing to the bearers, and the patient falls into a kind of doubled-up position which—especially in cases of fracture—is likely to greatly aggravate his injuries. Sailors' hammocks and cots may be used as stretchers by being suspended from poles: temporary stretchers of this description were used in the Crimea after the battle of Alma, and also in the Ashantee War. When two poles can be procured, or rifles, oars, boat-hooks, broom-sticks, rake-handles, bamboo-poles, or similar articles, temporary stretchers may be made in a variety of ways as follows:—

(a) By fastening loops to the four corners of a blanket, then folding the blanket, and passing one pole through the four loops, and the other within the doubling of the blanket. This arrangement is known as the *looped blanket*. If there is no time to fasten on loops, holes may be made at the four corners of the blanket instead. Counter-panes, rugs, table-cloths, and carpeting may be used in the same way.

(b) By fastening the sides of corn-sacks, flour-sacks, pieces of canvas, fragments of tents, hearth-rugs, over-coats, skins of animals, etc., to the two poles. General Jackson had his wounded carried on the skins of oxen slung between two muskets.

(c) By pushing the poles through the sleeves (turned inside out) of two coats, which are buttoned across; or by pushing the poles through the sleeves of one coat; or by pushing one pole through the two sleeves of a coat which is buttoned across, and rolling the tail of the coat around the other pole. The two last arrangements would only be of sufficient size to support a patient in the sitting-up position, his back resting against the foremost bearer, and his legs hanging in front of the hindermost bearer. The tunics and overcoats of soldiers, and the jerseys and "jumpers" of sailors may be made use of in the same manner.

(d) By stretching and looping across the two poles ropes of hay or straw, telegraph wire, ordinary rope, accoutrements of all kinds, girths, bridles, or stirrup straps. Netting fastened between the two poles would answer very well.

(e) By nailing or tying cross-pieces to the poles; and then making the body of the stretcher either with boards or with some soft material, as blankets, articles of clothing, canvas, etc.

One word of caution in connection with improvised stretchers of any kind:—*Before using one for the conveyance of patients, always test its strength by lifting a good-sized healthy man upon it.*

You should practise making temporary stretchers just as you accustom yourself to making improvised splints, bandages, pads, and tourniquets. It is astonishing how ready some people are in making the most of all their surroundings in case of emergency—improvising tourniquets, manufacturing splints, and contriving the means of transport out of almost anything within reach; while others, again, quite as willing but not so quick-witted, run about making a great fuss, and after all do next to nothing. The ability to display coolness, promptitude of action, and readiness of resource in the presence of some serious catastrophe, is to a certain extent quite a gift, and is not given equally to every one of us; but it is in the power of all, by frequent, careful, and steady practice, so to train themselves into the accurate and rapid performance of their various ambulance duties that, when opportunity occurs, they may render prompt and efficient “first aid” with the happy result of alleviating suffering, and it may be of saving life.

#### CONVEYANCE OF PATIENTS IN HORSE AMBULANCE SICK-TRANSPORT WAGGONS AND CARRIAGES, COUNTRY CARTS AND OTHER ORDINARY VEHICLES, SLEDGES, HORSE LITTERS, MULE LITTERS, ETC.

Wherever there are moderately good roads, vehicles drawn by horses form by far the quickest, easiest, least laborious, and altogether the best means of carrying the sick and injured: always providing that such vehicles are adapted—either by especial construction or by temporary arrangements—to the comfortable conveyance of patients, without jolting, exposure to the glare of the sun or bad weather, overcrowding, or other annoyances. Of all the skilfully-devised waggons, carts, and carriages (and there are many) which have been constructed for transporting the sick and injured, I have only time to allude to two varieties:—*The English Army Sick-Transport Waggon*; and the *Horse Ambulance Carriages*, designed and built under the direction of Mr. John Furley, which are supplied by the Ambulance Asso-



ciation. Our Military Ambulance Waggon, which is drawn by two or more horses (as occasion requires), is powerfully built and provided with strong springs, as it is designed to travel "with ease and security over any ground, soft, rugged, or broken, and down any declivity, over which the rest of the transport of the army can be taken";\* it is also "made so as to be readily taken to pieces, folded up, and to be put together into a convenient package, for stowage on board ship," in order that it may "be available for military operations in a foreign country":† it is "arranged for accommodating two slightly wounded men, together with the driver, sitting in front; two badly wounded lying on stretchers in the body of the waggon; and three slightly wounded, or two with an attendant, seated behind, and resting their feet on the ledge of the tail-board: the diameter of the fore wheels is 3 feet; of the hind wheels 4 feet 8 inches," so that the waggon can be turned on its own ground: a tank containing 10 gallons of water and a receptacle for forage are fitted beneath the floor of the waggon; and the floor is divided longitudinally down the middle by a wooden partition 14 inches high, on each side of which a Regulation Stretcher—with a badly wounded soldier lying on it—is run in upon its rollers: the sides of the waggon are 1 foot 8 inches high; and the framework forming the upper portion of the vehicle is provided with a water-proof double-canvas roof, from which single canvas sides can be pulled down or rolled up as high as is desired: "places are provided for the valises of the wounded men between the stretcher-handles, before and behind," and "there are also straps fixed to the floor of the waggon for securing the rifles of the wounded men:" and two spare stretchers are carried rolled up on each side "on the top of the side rail of the waggon." Several waggons of this description were used by the British National Aid Society in the Franco-German War: the vehicles were sent, made up into packages, by ship from Woolwich to Havre, where they were unpacked, and, the different parts being put together, all the waggons—twenty in number—were in five hours ready for the road: and though "they were subjected to very severe usage during the whole of several months in the trying winter of 1870-71; yet, in the following spring, they returned to England in so serviceable a condition that the

\* *Transport of Sick and Wounded Troops*, Surg.-General Longmore.

† *Gunshot Injuries*, Surg.-General Longmore.

Government readily consented to repurchase them from the Society to which they had been sold.\* Nevertheless the same waggon can scarcely be expected to suit equally well all the different countries, so varied in geographical character, in which British troops are called upon to act. The old Regulation Ambulance Waggons were considerably lighter than the new ones (which I have just described, and which weigh, *when loaded with patients, etc.*, about 30 cwt. each):



FIG. 43.—One variety of the Furley Horse Ambulance Carriage.

yet in the New Zealand War, their “weight and the absence of roads prevented even attempts from being made to take them into the field with the troops”; whereas, on the other hand, in India, their “very solidity and massiveness appeared to be the cause of parts yielding and breaking under the shocks met with in travelling,” and “at the Cape of

\* *Gunshot Injuries*, Surg.-General Longmore.

Good Hope, the waggons broke down under the violent concussion they were subjected to in going down the precipitous cart-tracks, and over the rocky drifts which constitute marked features of certain parts of that colony.”\*

It is impossible for me to describe accurately the *Horse Ambulance Carriages* designed by Mr. Furley, as that gentleman has never built two vehicles exactly alike, and moreover he constructs each carriage with the view of adapting it to meet the requirements of some particular locality. The Brighthouse carriage “will take four patients on stretchers, as well as attendants seated;”† and is described by Mr. Barber, the late Hon. Secretary of the Brighthouse Ambulance Institution, as *invaluable*. Another type of the Furley carriage (Fig. 43) is described by Surgeon-Major Evatt as “a one-horse ambulance carriage of varnished wood, with English oak wheels and sliding windows. It carries three patients; two on stretchers on the floor, and a third suspended from roof, and two attendants. The driver’s seat is hooded, and there is room for the two attendants on the box. The third stretcher is suspended by a hook from a little trolley with four wheels, which runs along two wooden rails (f) fixed to the roof of the vehicle. The handles of the stretcher are placed in the loops, and the trolley runs down to the far end of the carriage, the rear end of the stretcher resting on a padded bar (b) which juts out from the side of the vehicle, and can, if not needed for use, be detached at pleasure.”‡

I have had the advantage of examining the Wrexham carriage, which is a one-horse vehicle, made of varnished wood, with sliding side windows, a small movable window in front (through which the driver can be communicated with), fixed windows in the doors behind, and ventilators (which can be easily regulated) at the top of the doors and sides of the carriage. The carriage is designed to carry (on the left side) two patients on stretchers, these last being provided with telescopic handles and with little foot-rollers, on which the stretchers can be easily run into the carriage along wooden tramways. One stretcher rests on the floor of the carriage: and above it, fixed on vertical metal supports, is a tramway on which the other stretcher rests. The metal supports are

\* *Transport of Sick and Wounded Troops*, Surg.-General Longmore.

† *Carriage and Removal of the Sick and Injured*, Furley.

‡ *Ambulance Organization, Equipment, and Transport*, Surg.-Major Evatt.

hinged in such a way that the upper tramway can be temporarily pulled low down, so as to project horizontally through the doors, in order to facilitate the insertion or the removal of the uppermost stretcher. In the front of the carriage, in the right corner, is a seat for an attendant, which—if not needed—can be lowered: and there is ample room for the attendant to move up and down, in the right side of the carriage, if the patients should need his attention. Outside, under the driver's seat, is a box for "first aid" appliances, such as temporary splints, bandages, etc. Since the Wrexham vehicle was built, Mr. Furley has introduced several improvements in the construction of his ambulance carriages: thus he is able now to make a carriage about two feet shorter than the one at Wrexham, yet capable of carrying two full-grown persons on stretchers with a child and an attendant (or one grown-up person, two children, and an attendant), by prolonging the interior of the carriage forward under the driver's seat (thereby making space in front for the patient's feet) and doing away with the box which occupies that position in the Wrexham carriage. Mr. Furley has also succeeded in providing a new patent arrangement for putting in the upper stretcher, on the same level as in Fig. 43, in his carriages; and it is now, by this new method, just as easy to put in the upper stretcher as the lower. The prices of the different Furley Ambulance Carriages are now £40, £65, £80, and £140: I am informed that, for work in London, india-rubber tyres are necessary, and these add greatly to the cost.

I should mention that "Mr. Furley has also devised a system by which any private omnibus or such-like conveyance can be converted *pro tem.* into an ambulance transport-waggon. This is done by the same trolley system running along the roof of the carriage, and with loops suspended from it.

The handles of the stretcher are placed in the loops, and the trolley slides along the tramway, and runs the stretcher home into the carriage; the rear handles are then rested on a padded bar, which can be removed when not needed."<sup>\*</sup>

I am informed that this "convertible omnibus" has proved a great success; and that a new type is being constructed with removable seat and back cushions, in order to allow of

<sup>\*</sup> *Ambulance Organization, Equipment, and Transport*, Surg.-Major Evatt.

the interior of the vehicle being washed as easily as the exterior.

Should no properly built Ambulance carriages be available, nor any Wheeled Stretchers, you may be obliged to resort to *ordinary vehicles as a means of transport, such as drags, vans, waggons, and country carts*; more particularly if many persons are injured at the same time, if considerable distances have to be traversed, or if you are not able to collect a sufficient number of men to form relays of bearers for hand-stretchers. Large furniture vans are very convenient for such a purpose, as they are provided usually with good springs, and are capable of holding half a dozen or more patients in the lying-down position. I should mention here that methods have been devised by Surg.-Major Smith of the Norwegian Army, and also by the Austrians, whereby springless country waggons may "be adapted for the carriage of patients by temporary additions of rough and ready materials so applied as to act as springs."\* These plans consist of ingenious arrangements of pieces of timber and poles of springy wood, so as to lessen the jolting of the patients by the movements of the waggon; and may prove of considerable service in future wars, especially in countries "where agricultural hay waggons of a suitable form are in abundance." If no stretcher at all is available, neither any materials from which you can quickly improvise one, the bottom of the cart, van, or whatever vehicle you may be using, should be covered with some soft substance, as hay, straw, leaves, ferns, rushes, mattresses, mats, cushions, or clothes, and the patient should be carefully laid on the soft bed thus formed, being lifted in the way described for placing the sick and injured on stretchers, and one or two men being in the cart to assist. If, on the other hand, the patient is on an ordinary hand-stretcher, then the stretcher with the patient should, if possible, be slung in, and from the sides of the cart, care being taken that the lashings are not too slack, or the stretcher will knock against the sides of the cart, and not too tight, or the patient will be jerked with every slight movement of the cart. In some stretchers, the leather straps at each end have springs connected with them, so that when the stretcher is slung in a cart, jolting of the

\* "Report on the Conferences held at Geneva," 1884, by Surg.-General Longmore—*Army Medical Department Reports*, vol. xxv.

patient by the movements of the vehicle is greatly lessened. This is the case in the stretcher manufactured by Peck and Co. of Wigan: and a similar result is obtained by means of the Werber springs as used in France, which have sometimes been employed by Mr. Furley in this country, and which moreover have the advantage of being provided with hooks instead of straps, so that they can be attached to the side of any cart without a moment's loss of time. Should you be unable to manage the lashing of the stretcher to the sides of the cart, it is better to lay it gently on the bottom; and if the stretcher is provided with foot-pieces, these will suffice to keep the canvas—on which the patient is resting—clear of the hard wooden floor of the cart. Should the stretcher, however, not have foot-pieces, then straw, hay, rushes, or other soft material must first be spread over the bottom of the cart. Considerable care is always required in getting a stretcher, with a patient on it, safely into a cart; and indeed into any sort of vehicle, whether a specially-built ambulance carriage or otherwise. When the foremost bearer of the stretcher reaches the cart or carriage, No. 3 must take fast hold of the right-hand pole at the same time that the bearer turns around the left-hand pole which he continues to support. Of course the bearer must be very careful not to let the right hand pole go until No. 3 has firm hold of it. The foremost bearer and No. 3 then raise the poles of the stretcher to the required height—the bearer at the other end taking care to keep the stretcher level, and then (with the aid of the others) pushing it gently into the vehicle. Some stretchers such as that with which the British Army is supplied, being provided with four small foot-rollers, are easily pushed along the floor of a cart or ambulance waggon.

Circumstances sometimes occur under which no wheeled vehicles are obtainable: or, if obtainable, are perfectly useless; on account of the rough, broken, mountainous—or, it may be, the hot, parched, sandy, and stony—character of the country; or from the ground being covered and the roads being rendered impassable by snow. *Sledges* of ordinary construction are plainly the best and easiest conveyances over snow-clad districts. *Two-Horse Litters* have, on some occasions, proved the most efficient means of transporting the wounded; as, for example, during the war between the United States' troops and the Indians. These litters are made of two poles or branches about six yards long, con-

nected by cross-pieces and interlaced cordage, and carried by two horses in tandem fashion, the ends of the poles being supported in loops of the harness of the horses. Such a litter may be said to represent an ordinary stretcher, of which the two bearers are horses. *One-Horse Litters*—consisting of two springy poles, stems, or branches, connected by cross-pieces and interlaced cordage or twigs, and covered with a blanket or canvas sacking, the foremost end being attached to the horse and the hinder extremity trailing on the ground—act extremely well for the conveyance of patients, even over very rugged and irregular ground. One patient, or two patients placed side by side, lie in an inclined position on these litters, their heads being highest and nearest to the horse. It is stated that “not only under the management of the American Indians, but also in the hands of the United States Army Surgeons, the *travée*-litter (or one-horse litter) has frequently proved of great advantage in the transport of wounded men and officers, and that, on the whole, the transport has been effected with comparative comfort, and with no more jolts or concussions than are ordinarily met with in transport by wheeled vehicles. One United States Army Surgeon, from a large experience in the war with the Sioux Indians, has reported that, unless on very good roads, he considered the *travée* (one-horse litter) preferable to ambulance waggons”\* *Mule-litters* and *Mule-cacolets* or *Chairs* prove of great service under some circumstances: “they were found to be very useful in the Crimea for carrying the wounded along the narrow ravines leading up from Sebastopol; and also for conveying them from the camps to the ports of embarkation, before roads suitable for wheeled vehicles existed”; and in Algeria, “had it not been for these contrivances, the French wounded in many of the expeditions in the mountainous parts of that country, could not have been transported from the scene of action to a hospital.”† The Mule-litters are contrivances for carrying patients in the lying-down position, and are slung one on each side of a mule: the mule-cacolets or chairs are for conveying patients in a sitting posture, and are slung in the same manner. Similar contrivances, though called by other names, are used with *camels* for the conveyance of patients.

\* “Report on the Conferences held at Geneva, 1884,” by Surg.-General Longmore, *Army Medical Department Reports*, vol. xxv.

† *Gunshot Injuries*, Surg.-General Longmore.

## CONVEYANCE OF PATIENTS BY RAIL.

It may be necessary sometimes to transport patients by rail. Those who are injured in the arms, or slightly in the head, neck, or upper part of the body, can—after being dressed, and duly provided with splints, slings, etc.—easily travel in the sitting-up position. Persons who are hurt in the lower limbs may also travel in the sitting-up position, providing proper support, if necessary, can in one way or another be arranged for their legs. This may often be done by the simple method of cutting one or more planks to a suitable length, and fixing them across the front and back seats of the carriage, thus enabling the patient to travel sitting up with the legs raised. If patients have to be carried in a lying-down position, a difficulty exists in the fact that the doors of the railway carriages are barely large enough to admit of a stretcher being introduced: but in connection with this point, it must be remembered that the "*Furley*" stretcher can be passed through a doorway rather less than two feet in width, the joints of this stretcher being so arranged that the bearers can diminish the breadth to some extent without inconvenience to the patient.

A large second-class compartment is found to answer best; and it is recommended to place two strong wooden cross supports on the opposite seats of the carriage, each about a foot from the door. Room is thus afforded for two stretchers to be placed on the supports, one over each seat. Great care must be taken to move the stretcher gently and evenly into the compartment. No. 3 gets into the carriage first, and grasps one pole of the stretcher, while the foremost bearer turns around the other pole—holding it firmly until No. 3 also seizes *that*; the stretcher is then gradually moved into the carriage until No. 3 lays his end on the farthest cross support, when it is easily placed in its proper position by the three bearers acting together. During the journey an attendant should sit between the stretchers on one of the cross supports. In a first-class carriage, on account of the partitions separating the seats, only one stretcher can be introduced, and that placed over the interval between the seats. On the patient arriving at his destination, Nos. 1 and 2 place the stretcher along the middle of the compartment on the



cross supports; Nos. 1 and 3, descending on the platform, bear one end of the stretcher out of the carriage, the other end being carried by No. 2. On No. 2 reaching the door No. 3 goes to his assistance, and the stretcher is got clear of the carriage. Luggage vans, cattle trucks, and goods waggons are much more roomy, and may be prepared in the same way as country carts for the reception of patients by placing a quantity of straw or hay, mattresses, cushions, etc., so as to make a soft layer for the injured men to rest upon. The greatest importance in the present day is attached to the rapid and safe transport by rail of sick and wounded troops during military campaigns; and, as a consequence, much attention is directed—especially by the larger continental states—to the formation of regular *ambulance trains*; and, where that is inconvenient, to the fitting up of ordinary goods waggons, etc., with some kind of arrangement by which stretchers can be securely suspended or supported. The sick and wounded may be safely and comfortably transported—as they were on some occasions in the American Civil War, and also in the German War of 1866—by placing the stretchers, beds, or straw palliasses (on which the patients rest) on the floors of railway cars and waggons, over which hay or straw has been thickly and evenly laid. In the present day, however, special ambulance trains are constructed for the purpose of conveying the sick and wounded in time of war. The Austrians, more particularly, have reached great perfection in this matter; and have ready for use trains consisting of—besides the engine and guard's van—ten carriages, each arranged to carry ten stretchers; a dining waggon; store waggon, containing the eatables, etc.; a magazine waggon, containing instruments and other requisites; a kitchen or cooking waggon; and a sleeping carriage for the medical men, the carriages communicating one with the other, through their ends, along the whole length of the train. Moreover, the Austrians have another institution which we “Britishers” would do well to copy—*An organization for affording relief at railway accidents*. Railway waggons, Baron Mundy says, supplied with surgical appliances, stretchers, and fitted in such a way that good beds can be at once provided, are kept at all the great railway stations, in readiness to be used in case of accident, or to be forwarded to the scene of any great railway catastrophe: “medical men are registered, and they are called for and sent by special train.

They also have authority to go on horseback or in carriages, and the expenses incurred are liberally reimbursed. Every surgeon has his own badge, and the other trained men have their certificates and badges to make themselves known at once. They are provided with *matériel*. Ambulance waggons are only at the central stations, but they may be sent to any place where necessity requires them. Litters, boxes of appliances, lanterns, etc., are sent in great quantities.”\*

Considering the number of accidents which occur every year, in spite of the most careful management, on our different railways, surely our large Railway Companies might advantageously institute an Ambulance Organization in connection with their lines similar to the Austrian system; and might well insist that all their officials and men should be instructed in the methods of rendering “first aid,” and that all stations and also every train should be provided with a suitable stretcher, and such simple appliances as may be useful in an emergency.

#### MILITARY AMBULANCE ORGANIZATION.

To ensure that all sick and wounded soldiers, of an army engaged on active service, shall receive prompt assistance in the hour of need; and also that they shall be safely removed out of the press of battle or from an advanced post back to chosen spots where rest and skilled treatment can be obtained, and from whence they may, if necessary, be sent comfortably and easily by stages back to their own country and homes, even though hundreds and hundreds of miles—both by land and sea—may have to be traversed;—to ensure all this, I say, it is evident that the ambulance organization of an army must be very complete, carefully planned, and arranged on an exceedingly comprehensive scale. It is plain also that not only must the *matériel*—the stretchers, ambulance waggons, etc.,—be of the best, but the *personnel*—that is, the assistants, helpers, attendants, bearers, nurses—call them what you will—must be not only willing but *trained* to their work;—trained during times of peace so that they can duly perform their duties amidst the exciting and trying

\* *The urgent necessity for making Surgical Provision for Railway Accidents*, Baron Mundy.

incidents of war. Ambulance *matériel*, such as waggons, stretchers, and hospital tents, can be put together and stored up until required; but the enormous staff of trained assistants and helpers, both men and women, so necessary during a great war, cannot possibly be maintained during long eras of peace. When the signal for war is given, it is too late to teach people how to help, carry, and nurse seriously injured patients: the army has to be up and doing, yet after the first severe engagement, should there be insufficient ambulance arrangements, bearers, and helpers, the military force—even after a successful battle—will be practically crippled: for either it will be compelled to remain stationary, and so lose the advantages it has gained, in order to collect the numerous wounded, minister to their wants, and send them from the front—with a portion of the force—to positions of security; or, on the other hand, the army will be obliged to advance with its strength greatly reduced, many surgeons and a considerable detachment of troops being necessarily left behind to take charge of the wounded. But apart from such considerations as these, the troops—untrained in ambulance work, and fatigued with other duties—can only assist their injured comrades in a clumsy and inefficient manner: therefore the wounded may lie (as has often happened after great battles) scattered over many miles of country, exposed to the inclemency of the weather, during several days and nights before being collected and having their hurts attended to; and moreover their sufferings will be increased and their injuries aggravated during removal by the unskilful handling of their well-meaning but ignorant helpers. And that is by no means all: for, as may be imagined, immense labour, extreme patience, great skill, and a most carefully planned organization are necessary to ensure proper after-treatment and nursing of such large numbers of wounded men; and their safe conveyance, stage by stage, over hundreds of miles of a foreign—it may be a barren and desert—land, to the sea-coast, and from thence in the hospital ships across the ocean back to their own country. “The operation,” writes Surg.-General Longmore, “of collecting, removing, and attending to the first wants of the mass of wounded resulting from a great battle is a vast and serious concern. The manner in which this service is performed is not merely important in respect to preventing aggravation of existing suffering, but the question of life

itself, in numerous instances, is involved in the proceeding, and, in many others, the whole future state of the wounded, whether it shall be one of continued pain and of comparative uselessness, or the reverse of these conditions, will be influenced by it. It is a duty which not only requires the necessary amount of transport power, but also thorough organization, special training, immense energy, and undivided attention, for it to be conducted in an adequate manner. . . . But the removal of the wounded, and a general attention to their first wants, is but a small part of the work which their proper care and treatment demand, when armies are on active service.”\* The question then naturally arises,—Are the Military Forces of this country—the Regular Army, the Militia, and the Volunteers—provided with a suitable, complete, and workable ambulance organization, which will satisfactorily meet the requirements and endure the strain of a great war? The answer, it must be confessed, is most unsatisfactory,—“To-day,” writes Surgeon-Major Evatt, “it would be absurd to say that our own, or indeed any foreign army, is yet completely organized in an ambulance sense, but much progress has been made in the past thirty years in achieving efficiency, and there is much promise of good results in the immediate future; the one thing needed is an educated public opinion. . . .”

Turning from the regular army to the auxiliary services, we find our large Militia force completely defective in ambulance and medical arrangements, and it is now proposed that a body of militia, some 1200 men, should be trained annually in ambulance drill so as to form a supplementary help for the army in time of war, and this will be highly advantageous to the country.

Our large volunteer army 200,000 strong, is completely unprovided with bearer companies or field hospitals, and has nothing but some regimental help. There are probably not half a dozen ambulance waggons with the whole volunteer force.”† And again, “in case of war, a complete breakdown would happen, as there is not a bearer company or a field hospital equipment in the whole force. The volunteer army can shoot, and can march past, but it has no organised medical service, no transport, no commissariat, and is like the English army during the Crimean campaign—ready to

\* *Gunshot Injuries*, Surg.-General Longmore.

† *Ambulance Organization, Equipment, and Transport*, Surg.-Major Evatt.

break down in the field for want of definite forethought in peace.”\*

As I have already pointed out, it is impossible to maintain during peace an army ambulance service large enough to cope with the requirements of a great campaign in a foreign country: and therefore it is of vast importance that a *volunteer* ambulance service should be thoroughly organized, to act with the volunteer army, and also to serve as a reserve ambulance service from which large numbers of trained men may be drawn by the regular army in case of a great war abroad. Moreover, such a volunteer ambulance service may be easily formed; for what other nations can do *we* surely can also perform, and the Swiss army is possessed of an ambulance organization which “is as efficient as any in Europe, and it really amounts to a well-thought-out volunteer system.”† Efforts are now being made to drill and instruct the rising generation of doctors—in other words, the medical students of our different colleges and hospitals—in the details of military ambulance work; so that on going into practice and setting up for themselves, they may be fitted to act as Officers in the volunteer ambulance service, and also may be capable of rendering efficient and valuable assistance in case they volunteer for service with the regular army abroad. It is pointed out that about 1,000 volunteer surgeons, *over and above the existing Volunteer Regimental Surgeons*, are required for a properly constituted volunteer ambulance service, together with about 10,000 men—the whole body to be carefully organized and placed under medical (*not* regimental) control: and it is suggested that a volunteer ambulance corps should be established, in every county, consisting of about 10 Surgeons, as Medical Officers; 2 Quarter-masters, to take charge of all stores, equipment, etc.; and 100 Non-commissioned Officers and Privates, thoroughly disciplined, trained in all the varied duties of ambulance work, and instructed how to act in connection with Bearer Companies, Field Hospitals, and the other portions of an efficient and comprehensive military ambulance organization.

“The one thing needed,” as Surgeon-Major Evatt remarks, “is an educated public opinion.” When once the people

\* “Ambulance Arrangements,” etc., by Surg.-Major Evatt. *Health*, December 11th, 1885.

† *Ibid.*



of men, money, female nurses, equipment, organization, and transport—to lessen the sufferings of our sick and wounded soldiers, whether during “hard campaigns in Ashanti jungles, in New Zealand fern thickets, in the cholera-haunted defiles of Afghanistan hills, on the burning shores of the Soudan,” or on stupendous continental battlefields.

I will now try to explain to you, by means of the diagram (Fig. 44) with which Surgeon-Major Evatt has kindly provided me, the general plan on which our military ambulance arrangements are based. On reference to the diagram, you will see that a complete *Army Corps* is represented, consisting of a Cavalry Brigade, 1st Division, 2nd Division, 3rd Division, and a force called the Corps Troops: each of these large bodies is made up of several smaller, but thoroughly organized, bodies—thus, the *Cavalry Brigade* is composed of three Regiments of Cavalry, and a Battery of Horse Artillery; each *Division* consists of two Brigades of Infantry—of three Battalions each—and a Rifle Battalion (that is, of seven Battalions of Infantry), a Regiment of Cavalry, three Batteries of Field Artillery, and a company of Royal Engineers; and the *Corps Troops* are made up of five batteries of Artillery, with Engineers, etc

Now, to each of these smaller bodies of troop—that is, to each Regiment of Cavalry, Battalion of Infantry, Battery of Artillery, and company of Engineers—is attached, in time of war, a Medical Officer, whose business it is to give temporary help to the sick and wounded: and, during an engagement, this surgeon is accompanied by trained stretcher-bearers (with stretchers), drawn from the rank and file in the proportion of two per company, and by a soldier carrying a “field medical companion” (containing drugs and dressings), a water bottle, and a “surgical haversack” (containing surgical necessities); and in addition there are a pair of “field medical panniers” (containing medicines, instruments, etc), carried by a mule or pack-horse, which are in charge of a corporal so as to be ready for use during or immediately after the engagement. In the diagram, you will see posted behind each Regiment, Battalion, etc., the Surgeon with his ambulance men, who are properly instructed in ambulance drill and first aid to the wounded, and who form the *Regimental Ambulance Detachment*. These trained stretcher-bearers, when an engagement occurs, leave their rifles and valises in the carts of their corps, take the stretchers, and proceed to render immediate assistance to

the wounded as they drop, helping to apply the first hasty dressings, giving the wounded water and—if necessary—brandy, conveying injured men to the Surgeon, and helping along or carrying the wounded to the rear. The surgeon and the men of the regimental ambulance detachment keep near their corps throughout the fight, doing the best they can under fire to save and assist the wounded, and passing the injured men—after their hurts have been temporarily attended to—back into the care of the “Bearer Companies.”

The *Bearer Companies*, of which—as shown in the diagram—there are eight for the entire Army Corps (that is, two for each Division, one for the Cavalry Brigade, and one for the Corps Troops), form the *First Line of Medical Assistance*. Each Bearer Company is made up of three Medical Officers, and a Quarter-master, of the Medical Staff; and sixty-two Non-commissioned Officers and Privates of the Medical Staff Corps, which is a body consisting of men especially trained in the methods of rendering first aid, nursing, and all the various duties of ambulance work; and there are also Ambulance Waggon, a Surgery Waggon (containing instruments, and medical and surgical appliances), store-carts, water-carts, etc., and the Officer and men in charge of these vehicles. If the country is too mountainous or otherwise unsuitable for wheeled conveyances, then litters, cacolets (or “sling-chairs hung on to a pack-saddle”), field panniers, etc., are carried by mules. I must tell you that five of the Privates of the Medical Staff Corps of a Bearer Company act as Batmen, or servants to the Officers, so that but fifty-seven Non-commissioned Officers and men (as stated in Surgeon-Major Evatt’s description of the diagram) are free to do duty as stretcher-bearers, etc.; nevertheless the Batmen are trained men, like their comrades, and are therefore able to act in cases of emergency. During an engagement, each Bearer Company works as follows:—A *Collecting Station*, marked by a red cross flag, is placed well forward in a suitable spot, usually under shelter, but as near the fighting line as is consistent with safety; and further back, if possible out of fire, a *Dressing Station* is fixed, marked by two red cross flags during day-time and by two red lanterns at night, at which there are the “medical officer in command, one of the surgeons, and the quarter-master, together with the necessary medical and surgical equipment, medical comforts, and water-carts. If no building is available the surgery tent will be pitched, beef



tea and stimulants got ready, and every preparation made to succour the wounded as they come in." The company cooks, etc., with the baggage, "will be placed a short distance in rear of the Dressing station, and will have food ready prepared for the company at the close of the action."\*

The *Collecting Station* is placed "in charge of the sergeant-major, and with him a non-commissioned officer, having in his care the field companion and water-bottle and a small reserve of bandages and first dressings,"† in case the stretcher-bearers of the company should run short. The ambulance waggons, or other sick carriages, are also assembled at this point, drawn up with the horses' heads towards the Dressing Station. The stretcher-bearers of the company are sent forward, under one of the Medical Officers, in detachments—each of which consists of four men with a stretcher—to help and collect the wounded. The stretcher detachments, eight in number, with their surgical haversacks and water-bottles, move in front under fire, seeking for the wounded and assisting them by applying first dressings, stopping bleeding, and giving water and—if necessary—stimulants; and they "bring the wounded to the Collecting Station, and place them in the ambulances or other sick carriages, returning at once to the scene of action and taking fresh stretchers with them if necessary."‡ These stretcher detachments of the Bearer Company are assisted in their work by the Regimental Ambulance Detachments to which I have previously alluded; the latter either handing over their wounded to the men of the Bearer Company, or conveying them direct to the Ambulance Waggons at the Collecting Station.

As the ambulance waggons or other sick carriages are loaded with wounded, they are moved off at once to the Dressing Station, from which—after depositing the wounded—they immediately return to the Collecting Station. The full number of ambulance waggons and sick carriages in this—the *first*—line should always be maintained, and they should never go in rear of the Dressing Station during an engagement. The wounded, on arrival at the *Dressing Station*, are carefully examined, fed, operated upon if necessary, carefully dressed, marked by a ticket or "tally" (attached to the clothes) on which is written the regiment, number, rank, and name of the wounded man, as well as the nature of his injury,

\* *Regulations for the Army Medical Department.*

† *Ibid.*

‡ *Ibid.*

treatment, and other particulars; and, lastly, they are put into the ambulances of the *second* line, which are in readiness at the Dressing Station, to be carried still further back to the "Field Hospitals." Wounded men straggling from the battle-field have their hurts attended to at the Dressing Station, and are sent to the rear as quickly as possible: and badly injured men are conveyed, when practicable, without removal from the stretchers to the Dressing Station or even to one of the Field Hospitals.

In this way a battle-field is cleared of the wounded; but it is always very necessary to carefully search rough ground, woods, ditches, ruins, etc., as well as the open plains, so that no wounded men may be left uncared for. The men of the Bearer Company are provided with lanterns for the purpose of searching in the dark; and, as I have said, the Dressing Station is marked at night-time by two red lanterns. Experiments conducted at Vienna, Paris, Aldershot, and Geneva "with a movable electric light waggon, have established the possibility of lighting a large battle-field at night-time sufficiently to enable the wounded to be removed and the dead to be buried after verifying their identity"; and the Conference, held at Geneva in September, 1884, expressed the "wish that the electric light may be turned to practical account in future wars on all occasions when military circumstances will admit of its employment."\*

The *Field Hospitals*, of which—as shown in the diagram—there are fourteen for an Army Corps (that is, four for each Division, one for the Cavalry Brigade, and one for the Corps Troops), form the *Second Line of Medical Assistance*. Each Field Hospital consists of four Medical Officers, and a Quartermaster, of the Medical Staff; and forty Non-commissioned Officers and Privates (that is, inclusive of six Privates who act as Batmen) of the Medical Staff Corps; together with Ambulance Waggons, Water-carts, etc., and the Officer and men in charge of these vehicles. If the country is unsuitable for wheeled conveyances, the Hospital necessities and equipment are borne on mules or other animals. These Field Hospitals, each of which is arranged to hold one-hundred patients, and is fully equipped with blankets, tents, instruments, medicines, cooking vessels, etc., are readily moveable from place to place: and—when an engagement is imminent—are

\* "Report on the conferences held at Geneva," 1884, by Surgeon-General Longmore, *Army Medical Department Report*, vol. xxv.

established as close as possible to the First Line of Medical Assistance, on practicable roads for the ambulance waggons and other sick carriages from the front, and near a sufficient water supply. Advantage is taken of any available and suitable buildings in towns and villages for the establishment of these Hospitals; but when no buildings are available, the Hospital tents are pitched and the equipment, etc., arranged by the direction of the principal Medical Officer. The wounded are brought into the Field Hospitals—each of which is marked by a red cross flag in the day-time, and by a red lantern at night—from the Dressing Stations by means of the Ambulance Waggons and sick-carriages of this—the *second* line: but all patients are sent as soon as practicable to the other Hospitals in rear, those only being kept under treatment who are likely either to recover quickly or to suffer from removal. The men employed in connection with Field Hospitals are of course trained in Ambulance duties; and act in various capacities, as Nurses, Washer-men, Compounders of Medicines, Clerks, Cooks, etc.

If you refer again to the diagram, you will find represented a long winding road, called the *Line of Communications*, along which the Army Corps advanced; and along which reinforcements, provisions, etc., are forwarded to the army, and along which the sick and wounded returning from the front reach the rear. On this road, or Line of Communications, an *Advanced Dépôt of Medical Stores* is established (as shown in the diagram) as near to the Field Hospitals as possible. This dépôt is in charge of a Medical Officer, of the Medical Staff; assisted by a Sergeant compounder of Medicines, a Corporal as clerk, and two Privates as packers and storemen, of the Medical Staff Corps: it is moved forward as the troops advance; and it contains a sufficient supply of medical and surgical material for the Field Hospitals, Bearer Companies, and Corps in front.

Next, there are the "*Stationary*" Hospitals on the Lines of Communication, eight in number, each equipped to contain two-hundred patients; which are when possible, established in buildings or wooden huts at any port of embarkation, and in towns, villages, or farmhouses along the Lines of Communication, at regular and convenient intervals (so as to suit the position of the forces and the circumstances of the wounded), and, when practicable, near lines of railway and roads. The various posts, halting places, or stations held by the troops on the Line of Communications, and at which

food, ammunition, etc., are stored, and "Stationary" Hospitals established, are called *étappen* posts. If no buildings, huts, or other shelter are available on the Line of Communications, Hospital Marquees are erected in suitable positions: and though these Hospitals are styled "stationary," and are unprovided with any special waggon transport of their own, they may be readily moved if necessary. A Stationary Hospital consists of nine Medical Officers, and a Quarter-master, of the Medical Staff; and seventy-six Non-commissioned Officers and Privates of the Medical Staff Corps, eleven of which act as Batmen, the remaining sixty-five serving as Ward-masters, Stewards, Compounders of Medicine, Nurses, Washer-men, Cook, etc.; together with instruments, medicines, and equipment of various kinds.

A large *General Hospital*, arranged to hold five-hundred patients, is formed at or near the *Base of Operations* (that is, the port or other place in an enemy's country where the army lands, and where all the stores and reserves of the army are collected); or if it is not desirable to form a General Hospital on the sea-board, its place may be taken by a Hospital Ship. Besides this large Hospital at the Base—called from its situation the *Base Hospital*—a second General Hospital is established, if needful, in a more advanced position; as indicated by the *Advanced General Hospital* marked in the diagram. A General Hospital is worked by twenty Medical Officers, and a Quarter-master, of the Medical Staff; eleven Nursing Sisters; and 148 Non-commissioned Officers and Privates (that is, inclusive of twenty-five Privates who act as Batmen) of the Medical Staff Corps.

A *Depôt of Medical and Surgical Stores* is also established, as figured in the diagram, at the base of operations, for the supply of medicines and surgical appliances to all hospitals connected with the force, and also to hospital, troop, and transport ships.

Next, there are the *Hospital Ships*, provided with special fittings, such as ice-making machines, refrigerating chambers, dispensaries, etc.; and with Medical Officers, Nursing Sisters, Non-commissioned Officers and men of the Medical Staff Corps, and others connected with the management of the sick on board. Thus, there is a *Depôt Hospital Ship*, with steam power, capable of making 200 beds, or 250 on an emergency, for each division of the Army Corps: and there are one or more fast steam vessels, each making up sixty beds, employed

as *Relieving Ships* for the *Depôt Hospital Ships* to take the worst cases to England or elsewhere. There are also *Despatch Vessels*, each fitted out with about thirty canvass cots, to carry less severe cases to any available packet station to meet the mail packets.

And lastly, as indicated in the diagram, there are our own Hospitals of Netley, Portsmouth, and Woolwich, replete with every comfort, to one or other of which the sick and wounded are finally conveyed: and where they have the benefit of complete rest, careful nursing, and the highest professional assistance, until they are cured and able to rejoin their respective depôts or regiments, or, on the other hand, if permanently disabled, they are "invalided with a pension out of the army."

Such is a brief outline of the plan on which our Military Ambulance Organization is based; and in accordance with the provisions of this scheme, each severely-wounded soldier is promptly succoured, transferred from the battle-field to positions of safety, and, stage by stage, brought back eventually to his native land and home, as follows:—

1. He is, first of all, succoured by the *Regimental* (Battalion, or Battery) *Surgeon*; and the *Regimental Bearers* (who constitute the *Regimental Ambulance Detachment*). He has water—and, if necessary, brandy—given to him; his accoutrements and tight clothing are loosened; any dangerous bleeding is checked; and his injuries are hastily and temporarily "dressed."

2. He is next taken in hand by the *Bearer Company*. A "Stretcher Detachment" carries him from the scene of the fighting back to the "Collecting Station;" and from thence he is conveyed in an ambulance waggon or other vehicle to the "Dressing Station." Here he is thoroughly examined; operated upon, if necessary; properly "dressed"; supplied with food (beef-tea, soup, warm drinks, stimulant, etc., as needed), and allowed to rest.

3. He is then conveyed, as circumstances permit, to a *Field Hospital*.

4. As soon as practicable, he is (unless either too ill for removal, or, on the other hand, likely to recover speedily) transferred back to the nearest "*Stationary*" *Hospital*.

5. He is conveyed by "Sick-Convoy"—either in ambulance waggons, or other vehicles, ambulance trains, steamer, boats, or other means of transport—stage by stage, along the line of communications to the *Base Hospital*.

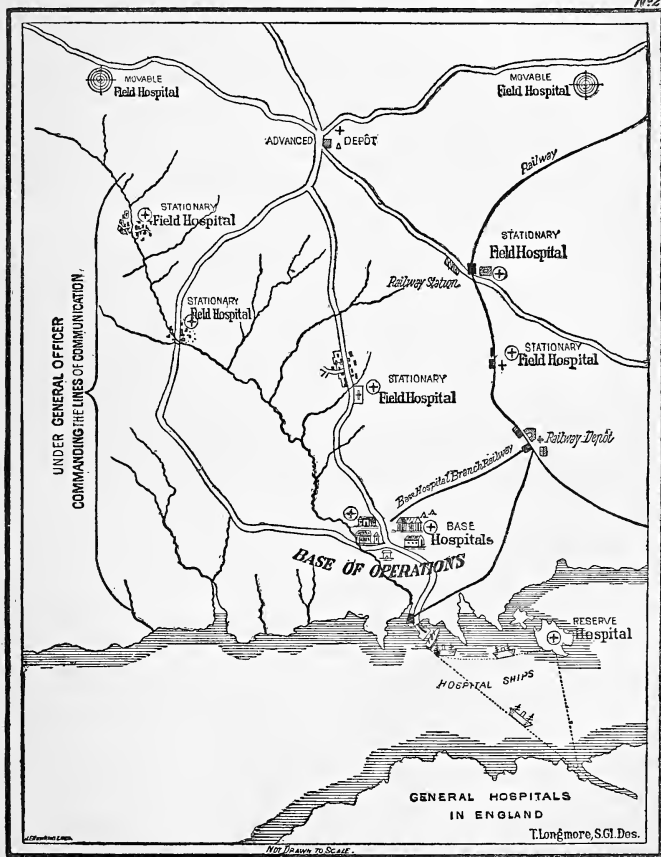


England, and placed in one of our excellent military Hospitals at home—Netley, Portsmouth, or Woolwich.

In conclusion, it is urged that—with the view of establishing

**SKETCH TO INDICATE THE HOSPITAL ARRANGEMENTS IN TIME OF WAR  
FOR THE SPACE BETWEEN THE FIELD HOSPITALS & THE HOSPITALS IN THE HOME COUNTRY.**

*Nº 2.*



*Intelligence Dep. N° 342.*

*Reproduced at the Intelligence Branch, War Office, 1909.*

**FIG. 46.—Relative positions of Movable and Stationary Field Hospitals, General Hospitals, Depôts, Hospital Ships, etc., in time of war.**

*an efficient Military Ambulance Organization in connection with the Volunteer Force, which may also constitute a reserve, in case of need, for the regular army—there should be formed (in addition to all existing Volunteer Regimental Surgeons and Regimental Stretcher-Bearers) one Bearer Company and one Field Hospital for each Regimental District, such bodies to be composed of Officers (i.e., Skilled Surgeons) and Men (i.e., men disciplined, and trained in all the varied duties of military ambulance work) of a Volunteer Medical Staff Corps. Such a Corps should be raised, in accordance with this scheme, in connection with every Regimental District, consisting of about ten Surgeons (as Officers), two Quarter-masters (to take charge of stores, etc.), and 100 Non-commissioned Officers and Privates (men of good character, healthy, disciplined, drilled, and trained in ambulance work).*

On the publication of the foregoing account of Military Ambulance Organization, Surgeon-General Sir Thomas Longmore very kindly presented me with two plans illustrative of the help-stations in time of war, remarking that, when Surgeon-Major Evatt's diagram (Fig. 44) is added to them, all the Field Medical (and Ambulance) Organization may be readily studied. I have much pleasure in now inserting reduced copies of these plans (Figs. 45 and 46), which, when carefully examined in connection with the diagram (Fig. 44) and letterpress on pages 165-171, show very clearly the Medical and Ambulance arrangements necessary in time of war.



## APPENDIX.

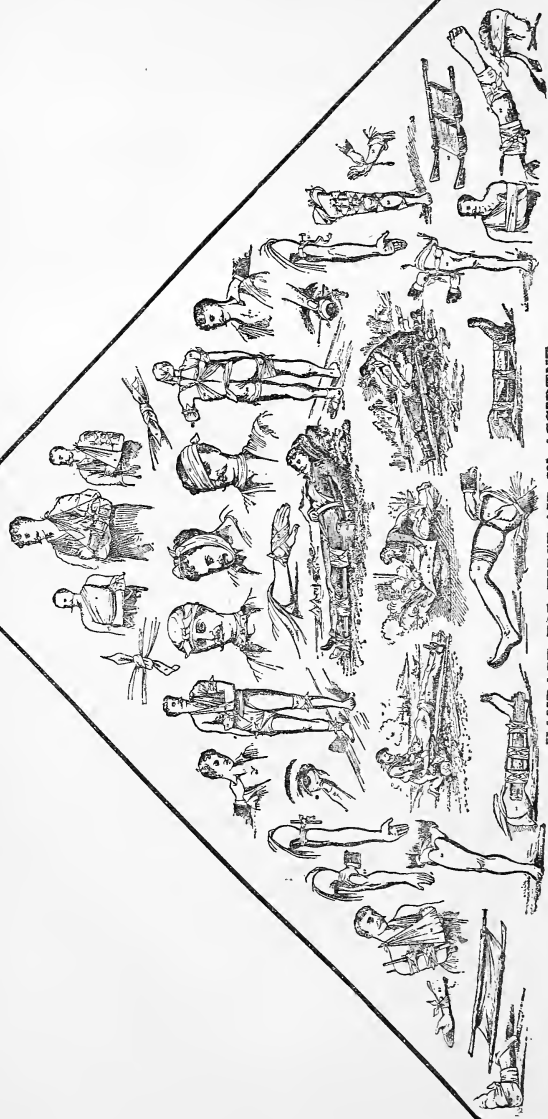
Illustrated Triangular Bandages—Precautions necessary in the presence of foul air and poisonous gases—What to do when dress catches fire—Rescue from drowning and ice accidents—Carrying by oneself, unaided, an insensible man—Rules for carrying stretchers—Special appliances for use in mines—Local Ambulance Corps, and Nursing Guilds or Corps—The Invalid Transport Corps—The St. Andrew's Ambulance Association—First Aid: Light, Warmth, and Water—The Signs of Death.

## ILLUSTRATED TRIANGULAR BANDAGES.

TRIANGULAR bandages, marked with figures showing the ways of applying them, are of great service to Ambulance pupils, more especially to those who have but little time for study or practice, and their usefulness is still further increased by each bandage being accompanied by a paper or book of printed instructions.

On Esmarch's bandage (Fig. 7), meant chiefly for the use of troops on active service, there is imprinted a sketch of "an ambulance place, behind the line of engagement, where the wounded soldiers are dressing each others wounds with the triangular cloth (or bandage)," the diagram on the bandage being "intended to instruct its owners as to the proper way in which to use it." As the figure of this bandage (Fig. 7) is much reduced in size, it may be usefully examined by means of a hand magnifying glass.

The bandage issued by the St. John Ambulance Association (figured in frontispiece) is illustrated by diagrams clearly showing its application in cases of wounds, in the binding on of splints, in fractures of the lower jaw and (in the central lowest figure) of the collar-bone. This bandage is accompanied by a paper of printed instructions. The bandage of the St. Andrew's Ambulance Association, an illustration of which the authorities have courteously permitted me to produce, has printed upon it no less than fifty designs, and is issued with a little book of instructions as to its application. The figure of this bandage (Fig. 47) will amply repay careful examination with a magnifying glass, on account of the numerous diagrams imprinted on it, showing clearly the varied uses of the triangular bandage, and also illustrating many other



**BANDAGE FOR FIRST AID IN ACCIDENT.**

FIG. 47.—Illustrated Triangular Bandage of the St. Andrew's Ambulance Association, designed by Dr. George T. Beatson. These Bandages, with printed instructions, can be had for 7*d.* each, or post free 8½*d.* each, on application to the Secretary at the Head Office (93 West Regent Street, Glasgow), or to the Hon. Sec. of any of the Centres of the Association.

things as well, as, for instance, improvised stretchers made "with two oars and canvas" and with soldier's knapsacks and rifles, fastened with their straps;" the "temporary treatment of fractured collar-bone;" a "fracture of upper arm put up with bayonet and scabbard;" a fractured fore-arm put up with "splints and large arm sling (the sling is represented as transparent);" artificial respiration by Sylvester's method; removal of foreign bodies from the eye; "extinguishing flames by wrapping in hearth-rug;" a "wound of fore-arm, with hæmorrhage, treated by local pressure with finger;" a broken thigh put up with "two long lateral splints and a short one in front;" etc.

#### PRECAUTIONS NECESSARY IN THE PRESENCE OF FOUL AIR AND POISONOUS GASES.

No one should venture into any old wells, pits, shafts, vaults, graves in over-crowded church-yards, brewer's vats, cellars full of new wine or beer, or drains, without first lowering into them a lighted candle: for, in such places, there is often collected a quantity of carbonic acid gas or "choke-damp." This gas, being heavy, accumulates next the soil or at the bottom of the well or vat; and if it exists in the proportion of 12 or 15 per cent., it puts out the candle (thereby giving notice of its presence) and would certainly suffocate and destroy anyone descending into it. This test is a very good one as far as it goes; as the foul air which extinguishes the candle would speedily be fatal to a man. But yet other precautions are needful, for a candle will burn if the "choke-damp" is only in the proportion of 10 per cent., a proportion which would quickly cause insensibility and death to man. Therefore, even if the lowered candle is not extinguished, the first man who descends into the well should have a rope securely fastened around him, so that, if he staggers or becomes unconscious, his companions at the top may rapidly pull him up. This precaution is all the more necessary as in certain places, as sewers, drains, and cesspools, other very poisonous gases (such as sulphuretted hydrogen) frequently accumulate, in which a candle will burn freely, but which are fatal very speedily to any one breathing them. The foul air in such places is sometimes

dangerously explosive, as when sulphuretted hydrogen is present in the proportion of about 7 per cent.; so that when applying the candle test, you must be careful that you are not injured by the gas bursting into flame or exploding.

When a man is suddenly overcome by the foul air of a well or other confined space, you can do no good by recklessly descending with the view of saving him; for, on reaching the gas, you yourselves will immediately be overwhelmed and suffocated. Many lives have been lost in this way, one after another being successively destroyed in vain attempts at rescue. The best way is to throw large quantities of lime-water (or, failing that, of water) into the pit; or to lower down buckets of quick-lime well sprinkled, or "loosely mixed into a paste," with water, as all these absorb carbonic acid gas: or the foul air may be displaced by a current caused by making a fire at the mouth of the pit, or by lowering a weighted open umbrella and pulling it up again—doing this repeatedly and quickly; or "what is better when available, by a jet of high-pressure steam."\*

Mr. Thomas Bell, H.M.'s Inspector of Mines, speaks of a case which came under his notice, where some men were overcome in a pit shaft 60 feet deep, when the workmen tied up some bundles of straw and threw them down with a cord attached, drawing them up and repeating this until the fresh air caused to circulate disturbed the gas, and they were then enabled to get down.

At the same time, however, that such steps are taken, ropes, and ladders (if needed) should be obtained: and one man, with a sponge or handkerchief soaked in vinegar and water bound over his mouth and nose, with a cord securely fastened about his chest (held by two men at the other end), and a signal rope attached to his wrist, should go down into the well and fasten the end of another rope (lowered down to him and held above also by two men) around his suffocated comrade for him to be pulled out. One of the men at the top should have sole charge of the signal rope, and see that his signals are regularly answered by the rescuer, who should of course be pulled up if any signs of faintness or unconsciousness show themselves.

People are sometimes suffocated by poisonous gases above ground: for instance, in dwellings by the vapour of burning

\* *Medical Jurisprudence*, Taylor.

charcoal, as when rooms are warmed by charcoal-braziers; or by coal-gas, escaping from the leakage of pipes or from not being properly shut off at the taps or meter; or by the smoke of a burning house.

The utmost care is needed, in rescuing anybody from a room full of charcoal vapour or coal-gas, to establish free ventilation by breaking in the door, and also the windows from the outside. If the windows cannot be got at from the outside, the rescuer, having first taken a deep breath, should hold a handkerchief or sponge soaked in water, or vinegar and water, to his mouth and nostrils, then dash through the room and break open the nearest window, pushing out his head to inhale some fresh air, before hastening to the next window, and so on till free ventilation is established, when those lying helpless can readily be got out and attended to. The presence of coal-gas is readily detected fortunately by its horrible smell, and as it is most dangerously explosive, no light must be used by the rescuers. In the case of the smoke of a burning house, the following remarks by Captain Eyre Shaw\* are very instructive.

“Should it be found difficult to breathe in a room on fire or full of smoke, it will be found an advantage to go on the hands and knees, with the head low down, as there is often pure air close to the floor even when it is impossible to see across the room; and by placing in the mouth a pocket-handkerchief, or any substance through which the air can be filtered, it is quite possible to remain for several seconds in a room under these conditions; and, if the pocket-handkerchief or other article be previously dipped in water, it will be found a still more efficient respirator.”

“To relieve a room of smoke, it is best to open a small portion of the window, by breaking the glass, or otherwise, both above and below, in which case the cool air will come in underneath, and the hot air and smoke will pass off from the top.”

“It cannot be too often impressed on a fireman, that so long as there is flame there must be plenty of oxygen to support it, and that consequently there can be no difficulty in finding plenty of air to breathe—in other words, that so long as the fire is burning brightly, a man cannot be smothered. He may, it is true, be burned, blinded, or otherwise injured,

\* *Fire Protection*, Eyre Shaw.

but it is impossible, under such circumstances, that he can suffer from want of air; on the contrary, so long as he can keep his head below the seat of the fire, he will feel a very considerable draught, and will experience no difficulty whatever in breathing."

### WHAT TO DO WHEN DRESS CATCHES FIRE.

*If your own dress*—throw yourself at once on the ground (so that the rising flames may not catch the upper part of your clothes nor burn your head and chest); roll about (so putting out the flames by pressure); and at the same time, if possible, wrap yourself up closely in a rug, hearth-rug, blanket, table-cloth, overcoat, or carpet (so as to smother the fire). Do not get up to call for assistance, but for that purpose crawl to the bell-rope or door.

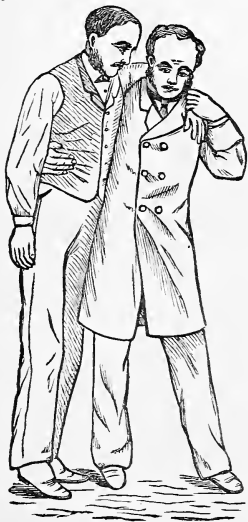


FIG. 48.—Giving aid by means of one Helper. See page 127 (a).

*If another person's dress*—throw the person on fire down at once, and wrap him (or her) up in a rug, blanket, or similar article, or, if nothing at hand is suitable, use your own coat, rolling the patient about in it (for the purpose of smothering the flames). It is difficult for a woman to give aid of this kind without considerable risk to herself; hence the advice of Professor John Marshall, "if a woman render assistance she must be careful not to approach the patient except by her head, so that the flames may not attack her own clothes." If any

"smouldering" of the dress continues after the flames are extinguished, pour a quantity of cold water over it.

### RESCUE FROM DROWNING.

*The Pocket Grapnel* (as improved by Major Scott, formerly Hon. Sec. of the Dover Centre) is an instrument supplied by the St. John Ambulance Association for the purpose of rescuing

people from drowning. It is light, weighing only  $6\frac{1}{2}$  ounces : strong, as each Grapnel issued has been tested up to 2 cwt. : cheap, for the price of Grapnel, a leather pocket to hold it, with a strap to be worn across the body, is but seven shillings : and it is really of use, since I am told that it "has undoubtedly saved many lives. At Dover several instances could be quoted, and the Coastguard services in France have been supplied with them for many years." The directions for use are :—"First throw the wooden reel, retaining the hooks of the grapnel in your hand, but should the person in peril sink, then throw the grapnel, retaining your hold

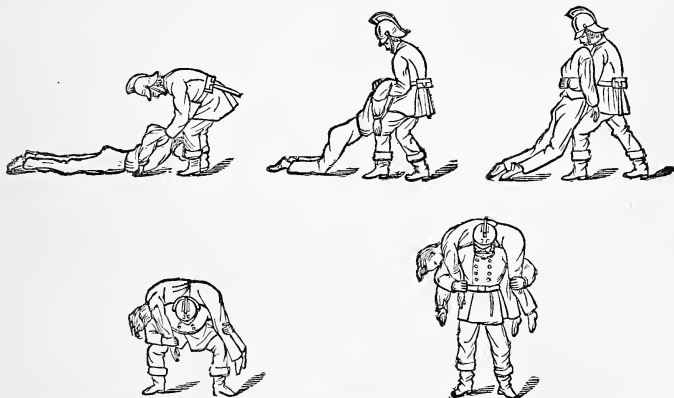


FIG. 49.—Picking up and carrying by oneself, unaided, an insensible man. See pages 127-8 (*d*).

of the line. Endeavour if possible to hook the clothes. A little practice is advisable. The line, when not in use, should be kept dry." If no grapnel is at hand, it is best to throw a rope to the drowning man, or an oar or other piece of timber for him to catch hold of. "If, however, there is nothing of the sort at hand," Esmarch suggests that "one should pull off his coat, and holding it by one sleeve throw the other or the coat-tails to the drowning person, thereby establishing a communication with him." Professor Esmarch was told by an old ship's captain "that he had saved many lives in this way."

## RESCUE FROM ICE ACCIDENTS.

*Ice balls* (invented by Herr Rüdel, of Kiel), price ten shillings and sixpence each, are supplied by the St. John Ambulance Association, for the purpose of saving life in ice accidents, when the ice is too weak to bear. It is described as consisting "of a wooden ball to which a metal axle and a few yards of rope are attached, and this may be easily projected, even by women, to anyone in danger of drowning; or where the piece of water is not too broad, it may be bowled from shore to shore, and the rope thus drawn across the surface and put within reach of the person in peril.

The line, when not in use should be kept dry." Under similar circumstances, ropes may be thrown along the ice, or ladders, planks, or poles pushed towards the person in danger.

## CARRYING BY ONESELF, UNAIDED, AN INSENSIBLE MAN.

The plan shown in the illustration (Fig. 49), and described on page 127, is that recommended by Captain Eyre Shaw for Fire Brigade men. If it is wished to send the person carried down a Fire Escape, Captain Eyre Shaw adds to his other instructions—"In this manner, carry the person to the window where the escape is pitched, and raise the feet to the mouth of the shoot with one arm; then take hold of one of the wrists, and ease the body gently off the shoulders into the shoot, always taking care to keep the face uppermost. As a rule, women should be passed down a shoot head foremost, and men either way. When women are passed down the shoot feet first, a small line should invariably be used to tie round their clothing, in order to prevent it from catching in the shoot." To carry children down ladders, the same authority says: "place a child under each arm, and grip each tightly by the elbow and forearm, in such a way as to leave both hands quite free to take hold of the sides of the ladder. Another way, is to place one child under the arm, and the other over the same shoulder, and lay hold of the latter with that hand, which leaves the other arm and hand quite free for taking hold of the ladder in descending."



## RULES FOR LIFTING AND CARRYING ON STRETCHERS.\*

When, from want of space, a stretcher is of necessity laid *by the side* of a patient (as explained on page 139), the advantage of the bearers, Nos. 1, 2, and 3 being *on the injured side* of the sufferer is that they can more easily support the injured parts, the chests of the bearers assisting in the support. Thus, in the case of a broken arm, leg, or thigh, after putting on some temporary splints, the patient can be



FIG. 50.—An insensible man carried by two bearers. See page 132 (*f*).

raised and held more easily and securely, until the stretcher is moved into position, with the bearers on the same side as the broken limb; while as soon as the patient is on the stretcher, the hands of the bearers are free and close by to do anything that may be required for the injured parts.

## SPECIAL APPLIANCES FOR USE IN MINES.

Stretchers are supplied by the St. John Ambulance Association, especially intended for use in mines, which are provided with telescopic handles, *so that the length can be adapted*

\* *Stretcher Exercise*, No. 2, St. John Ambulance Association.

to the size of the "Cages" employed. And for mines in which, from want of space, a stretcher cannot be placed in the "Cages" in a horizontal position, the "Lowmoor



FIG. 51.—Furley's Lowmoor Jacket. See page 142.

Jacket" (Fig. 51), described on page 142, can be used with the ordinary folding stretcher; and in this way an injured person can be safely placed at any angle—as shown in the illustration. Moreover, the Association supplies stretchers similar to those mentioned above, with telescopic handles, which are also jointed in such a manner that they can be placed in coal tubs or the smaller cages. The "Tibshelf Ambulance Tram," described on page 143-4, is another eminently useful appliance for underground workings. "Ambulance Hampers," with waterproof cover and strap, containing splints, lint, bandages, and other first aid requisites, are issued by the Association, and are found highly serviceable for collieries, mines, railway stations, and other works, as well as for domestic use.

## LOCAL AMBULANCE CORPS; AND NURSING GUILDS OR CORPS.

To reap the full benefit of Ambulance knowledge, as well as to sustain such knowledge when once acquired, it is found an excellent plan to group men who possess "Ambulance Certificates" together into organized bodies or *corps*—this more especially in towns, and in connection with collieries, factories, large railway stations, and other centres of labour. These "Local Ambulance Corps" are attracting much notice, from the valuable services they perform. Each Corps of course possesses certain officials, such as Secretary, Treasurer, Captain, and so forth; is provided with a carefully prepared

list of rules for the guidance of the men ; assembles at stated intervals to practice stretcher drill or to receive instruction on especial points ; and there are placed, in certain well-known localities, hampers or valises of first aid appliances, stretchers, litters, and, in some cases, ambulance waggons,



FIG. 52.—Stretcher of St. Andrew's Ambulance Association—without awning.

ready for use as occasion arises. The members are necessarily well acquainted with (or, better still, are each provided with a list of) the names and addresses of their fellow members ; and arrangements are made as complete as possible whereby the corps can be assembled speedily when called upon. As examples of such corps, I may refer to those located in Leicester, Northampton, and Derby.

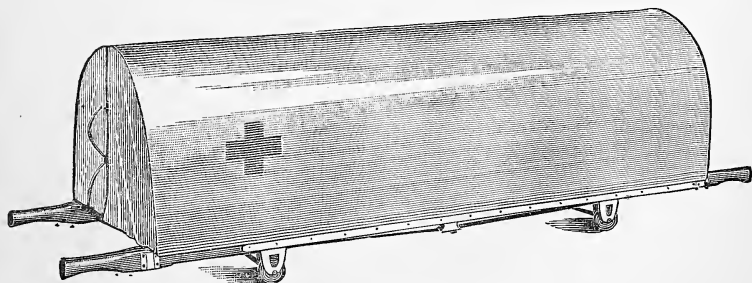


FIG. 53.—Stretcher of St. Andrew's Ambulance Association—with awning.

In *Leicester*, there are three principal Ambulance Corps, viz., The Town Corps, The Railway Corps, and the Gas Department Corps, each being self-supporting and having its distinctive badge. I am told that the head quarters of the

Railway Corps are at the Midland Railway Offices, where a supply of first aid appliances and a stretcher are kept, similar stores being ready at the principal junctions and shunting stations, and that arrangements exist by which at least thirty men can be got together, in case of need, in less than 10 minutes to proceed to the scene of any accident.

The Gas Department Corps is very completely equipped, for in addition to splints, stretchers, etc., a number of hampers are placed in different parts of the works (where most likely to be needed) with supplies of lint, tow, bandages, and remedies, with a card showing what remedy or restorative is to be used in different emergencies. Each remedy has a

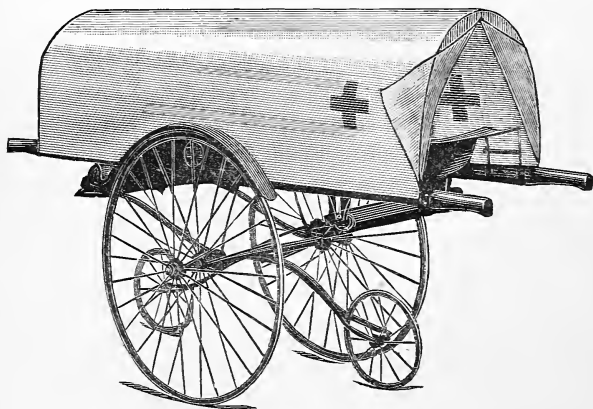


FIG. 54.—Wheeled Litter of St. Andrew's Ambulance Association.

letter against it on the card; and each remedy has the same letter, as well as its name in English, on the bottle, box, or parcel in which it is contained. All the men are provided with these cards. There is also stationed a wheeled litter at each of the two large Gas Works, for public use. Besides these, there are established, in connection with the Town Corps, five other Hand Ambulances in different parts of the town, and a House Ambulance Waggon at the Town Hall. Cards, etc., are circulated with the positions and custodians of all these Ambulances printed on them, and the latter can *always* be obtained, upon proper application, for use in cases of sickness (non-infectious) or accident.

The *Northampton Ambulance Corps* has already attracted notice by its complete organization. Its chief officials are a Superintendent, a Director of Ambulances, an Inspector of Material, and the Superintendent's Secretary. Each separate part of the corps which holds a separate drill is called a "Division," and each Division has a Captain, Treasurer, and Secretary. There are now, I am informed, 21 Divisions, comprising some 350 men on the rolls. All manner of men are represented in the corps, and strive by friendly competition to become proficient in their voluntary work; thus, amongst others, there are the Police, Gas Employés, Fire

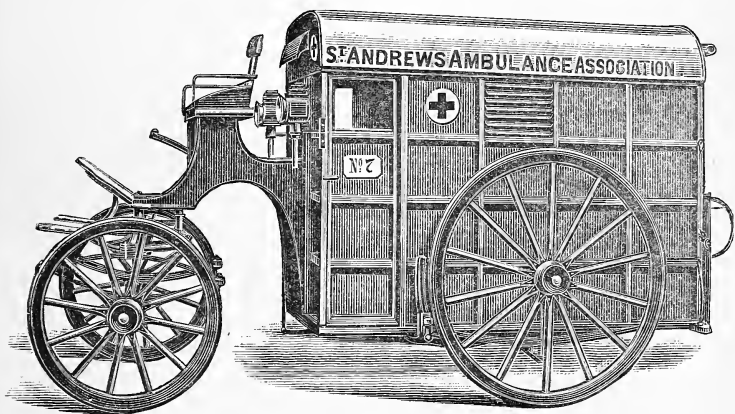


FIG. 55.—Ambulance Wagon of St. Andrew's Association—side view.

Brigade men, Rifle Volunteers, Athletes, and the Employés of two Railway Companies. Monthly Drills are held to keep up the efficiency of the men: and three Medical Inspections are held, and three Lectures are given every year. A list of the names and addresses of the men are posted up in all public buildings and telephone rooms, and a similar list is carried by each individual member. There are eighteen stretcher stations, at each of which is an Ambulance Valise, containing First Aid Appliances, and a Stretcher or (in two instances) a Wheeled Litter. Subscriptions are also being

rapidly collected to purchase an Ambulance Waggon. Further, "the corps furnishes contingents to all large Public Fêtes, with all necessary ambulance appliances;" and transport work is also undertaken, one patient being removed from Northampton to Glasgow by the corps, "never leaving the stretcher on which he was originally placed till the end of his journey."

In *Derby*, there is (besides other Ambulance services) an Ambulance Corps connected with the Carriage and Waggon Department of the Midland Railway. The Corps meets for practice and drill on alternate Wednesdays; and members must attend at least half of the meetings for drill and instruction held during the current year, or they are disqualified for competing for Prizes. Members of the corps pay in advance one shilling per annum, and these subscriptions cover expenses, since the Company provides First Aid Appliances for use in accidents. In each shop of the works, there is an Ambulance Bag (containing lint, bandages, and other requisites), a set of Splints, a list of the Ambulance Men in the shop hung up in a conspicuous place, a bottle of carron oil where required, and a Committee-man, who sees that the Ambulance bag is always in order and well supplied with stores, and that the men on his list attend to their drills and keep themselves generally efficient. There are also two canvass stretchers, and one ambulance carriage, distributed in suitable places about the works.

These are but a few instances of Local Ambulance Corps; but there are many others, and fresh corps are continually being organized as the Ambulance movement progresses and developes. Moreover, just as Ambulance Corps are usefully constituted for men, so there are established NURSING GUILDS (or CORPS) for women. One of these exists at Leicester, and though of recent origin, it seems "calculated to be of great practical use," and it of course serves to keep the "Certificate holders together, and to enable them to keep up their knowledge and skill in practical nursing." As another good example of a Nursing Corps, I would quote that established in Oldham, from which (on proper application) "Nursing Associates" may be had to take care of cases, the duties of the Nurse being—

1. To carry out conscientiously the directions of the medical man in attendance.
2. To see the case daily, or as often as necessary.

3. To advise and assist in the general sanitation of the sick-room ; in the preparation of invalid diet ; in the arrangement of the bed ; in the making and application of poultices, fomentations, or surgical dressings ; in taking temperature and noting it on the chart when required ; and in procuring and supervising the use of such nursing materials as the case may demand.

### INVALID TRANSPORT CORPS.

One of the greatest obstacles in the management of patients, either sick or injured, has always been, until recently, the difficulty of moving them easily and safely from place to place. It is often desirable to carry a patient from one room to another, one house to another, frequently from one part of the kingdom to another, even from this country to some favourable spot abroad, or it may be from a foreign state back to Britain. This conveying of patients, formerly so difficult, expensive, and dreaded a business, is now managed both easily and cheaply, being accomplished by the proper use of certain especially constructed appliances, as stretchers, carrying chairs, litters, and ambulance carriages. The essential article is really the Stretcher ; and the stretchers used by the Corps are of a particularly useful pattern, as they are made with either plain or telescopic handles, and, as their width can be reduced without disturbing the patients on them, they can be put into any railway carriage or ship-cabin. Moreover, all these stretchers are interchangeable, and can be fitted on to any of the two-wheeled hand litters, and placed in any of the Horse Ambulance Carriages, constructed by the St. John Ambulance Association, and used by the Invalid Corps. The two-wheeled hand litters are also very carefully designed for their proper uses. "We adapted," says Mr. Furley, "our two-wheel litter to the regulation pattern stretcher of the Army. That would not be of much use on the field, but it is of considerable use in the military stations at home. We have also adapted it to the Navy cot for the Admiralty—so that an invalid in a cot when a ship arrives can be disembarked and immediately put on one of these two wheeled litters, and taken to the hospital."

To explain more clearly the way in which the removal of patients is managed, I will quote one or two instances; but first it is right to explain that the *Invalid Transport Corps*, which takes this good work in hand, consists only of three or four Members, all however enthusiastic and skilful, and stimulated by the example of their leader, Hon. Secretary, and Manager—who is also the originator and founder of the Corps—Mr. John Furley.

A gentleman was conveyed safely and easily in a bed arranged on a stretcher from Cannes (a port on the South

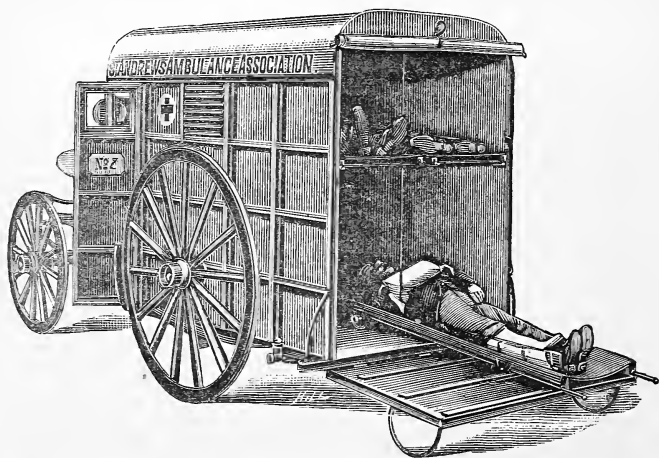


FIG. 56.—Ambulance Waggon of the St. Andrew's Ambulance Association—end view.

Coast of France) to London. At Cannes, the stretcher was taken, with its burden, on a wheeled litter from the house to the railway station, and then placed in the train. When the train reached Calais, the stretcher was removed to the steamer, from which it was again transferred at Dover to the train; and on the arrival of the latter in Charing Cross Station (London), it was placed in an Ambulance Carriage, and the invalid was so driven to his home. In this case, the patient was a "distinguished statesman." I will now give a case nearer home and in another sphere of life. There was a poor girl, very ill indeed, at Reigate, in Surrey, who said



she "would rather be a month in London with her mother than a year at Reigate without her." Two of the corps went down to Reigate, with a wheeled litter in the luggage van; the patient, comfortably placed on the stretcher, was wheeled on the litter to the station, put into the train, and wheeled away again, on arriving in London, to be laid in bed "on the third floor of a house where her mother was lodging;" and, remarks Mr. Furley, "the total charge, including the railway tickets for the girl, her mother, and the men was thirty shillings, that was all we asked the lady who had kindly undertaken to pay." Similarly, patients have been moved,



FIG. 57.—Ambulance Knapsack of St. Andrew's Ambulance Association  
—closed.

without taking them off the stretcher, to Scotland and Ireland, Germany and the Mediterranean.

More recently a Carrying-Chair has been designed, in which a patient, when needful, may be carried in a sitting position; and it is so constructed that, when desired, the invalid can be gradually lowered and the chair used as a bed. This chair can be used up and down stairs, and can be placed in an ordinary railway compartment as well as in any of the Ambulance Carriages of the corps. To quote again from Mr. Furley, "in this chair, an invalid can be moved to the

railway station, wheeled down the platform and lifted into a carriage, and if necessary, travel right across Europe in it."

It only remains for me to add that arrangements can be made for the removal of invalids (infectious cases excepted) both within the United Kingdom, and to or from any part of the Continent of Europe, by applying to John Furley, Esq., St. John's Gate, Clerkenwell, London, E.C., with the addition of "Transport Corps" in the upper left hand corner of the envelope.

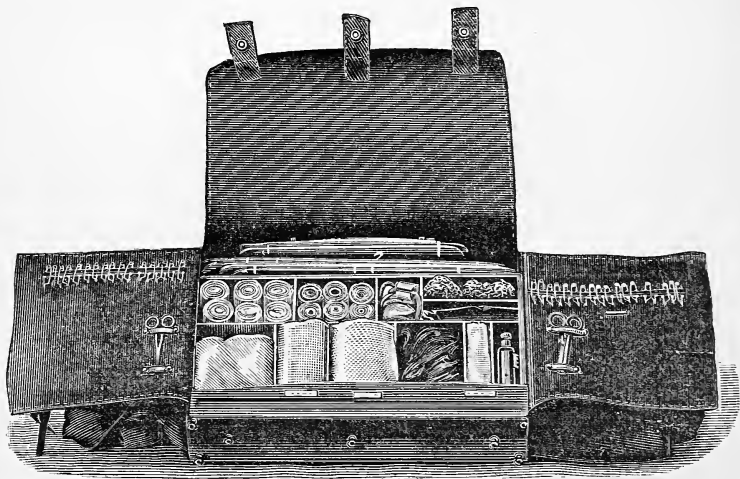


FIG. 53.—Ambulance Knapsack of St. Andrew's Ambulance Association—open.

#### THE ST. ANDREW'S AMBULANCE ASSOCIATION.

My account of Ambulance work and its rapid development would be incomplete were I to leave unnoticed the *St. Andrew's Ambulance Association*, justly described as "a useful and benevolent institution," which "bids fair, before long, to embrace within its folds the whole of Scotland."

Established in the spring of 1882, with its head quarters in Glasgow (93 West Regent Street), this Society resembles the St. John Association very closely in its objects and

methods of working. By means of First-aid Classes, instruction is given to people of all ranks and grades of society as to the ways of giving useful help to the injured and the suddenly stricken, *pending the arrival of a medical man*; and further, arrangements are made (by placing Ambulance Waggon, Wheeled Litters, Stretchers, Baskets or Knapsacks of first-aid appliances in convenient spots, and teaching people how to use such articles) whereby the sick and the maimed may be speedily attended to, and rapidly, comfortably, and safely carried to their homes or the nearest hospital. The Association makes and issues its own Ambulance Appliances; thus, it has its own Illustrated Triangular Bandages (Fig. 47), its own Stretchers (Figs. 52, 53), Wheeled Litters (Fig. 54), Ambulance Waggon (Figs. 55, 56), and Baskets and Knapsacks of First-aid requisites (Figs. 57, 58). The formation of Local Ambulance Corps is encouraged; and, as a matter of fact, several corps exist and work well in connection with ship-building, engineering, chemical, iron, thread, locomotive, and other works. In order to ensure uniformity in the drill of such Corps, four Stretcher Exercises, (adapted to four, three, and two bearers, under variable conditions) have been arranged by Dr. W. A. Wilson, of Greenock, and revised by the Medical Sub-committee of the Association. Much importance is naturally attached to the employment of "properly equipped Ambulance Waggon," of which Glasgow has three, Greenock two, and Edinburgh, Coatbridge, Baillieston, Dumbarton, Hamilton, Govan, Paisley, Pollokshaws, and Wishaw, one each. These "*Ambulance Waggon are at the call of any person by day and night, free of all cost and responsibility.*" It is expressly stated that "on receipt of alarm by messenger, telegraph, or telephone, they will be sent with all possible speed to the scene of accident, and the trained attendant who accompanies the waggon will, pending the arrival of a doctor, temporarily dress the injuries, and take every care of the injured person during the drive home or to the Infirmary."

And it is further remarked that "the Central Executive wish to see an Ambulance Waggon in every town and manufacturing district in Scotland, and will give all the help they can towards this end."

When it is practicable, the Central Executive permit these Waggon to be used for the conveyance of persons who are ill (from *non-infectious* diseases) from one part of the town or country to another.

## FIRST-AID: LIGHT, WARMTH, AND WATER.

In connection with the Lymington Ambulance Centre, Dr. Braxton Hicks has contrived a simple plan by which "Light, Warmth, and Water" may be conveyed, with a litter or stretcher, to the injured; and this, it is needless to add, may prove of vital importance under some conditions, such as wintry or rainy weather, long exposure of the injured to wet, cold, etc. For *light*, he uses a Hinek's stable lamp, to which a tin shade is adapted to shield the eyes when attending to the patient on the ground; this can be swung between the front handles of the litter, and "when the patient is on it it should be brought close beneath his feet so as to give warmth; and, again, when the tent is over him the warm air will pass up beneath and so give warmth to the whole body." But for *warmth* more especially, Dr. Hicks has "a *copper bottle* of a gallon and a half, tinned within, with a screw plug. It is of concavo-convex shape, for feet or chest, etc. If filled with boiling water and rolled up in a rug, it will be quite hot three hours after, and fairly warm seven hours. When, however, the litter arrives at the injured, the water can be used to drink, mixed with beef extract, spirits, cocoa, etc., readily added to the hamper." Lastly, he adds a pint water bottle and cup of vulcanite, like that used by the Indian sportsmen; this holds cold water for the injured or the bearers, (very grateful for either in hot weather).\*

The Horse Ambulance Carriages of the St. John *Invalid Transport Corps* are fitted up with appliances for giving Light, Warmth, and Water; and purchasers of Stretchers, Litters, and Ambulance Carriages from the St. John Ambulance Association can have the same provided with similar appliances on application.

The Ambulance Waggon of the St. Andrew's Ambulance Association are chiefly used for conveying the injured from large works in a town or its outskirts to the infirmary, and as the time taken is very short, no special apparatus for heating is necessary. For longer journeys, however, hot water bottles are used to produce warmth. As regards light, each Waggon is provided with a lamp inside, and, moreover, the light from the carriage lamps is reflected inside.

\* *Lancet*, March 24th, 1888.

It appears to me that men of Local Ambulance Corps can usefully exercise their ingenuity in devising methods by which light, warmth, and water may be taken with their litters or other vehicles to the spot where the injured are lying—methods suitable to the particular transport material available, and adapted to the character of the country in which the corps is situated.

I should add that, as regards Dr. Braxton Hicks' suggestions, the Hinek's lamp, burning rock oil (which remains good when out of use) will keep alight for twelve hours, and cannot be put out by the wind. Further, Dr. Hicks states as to the cost of his simple apparatus:—"The lamp can be obtained everywhere; with shade, made by any tinman, to fit over handles, the whole costs about two shillings and six pence; the copper bottle, tinned inside, made by Allen, Marylebone-lane, fifteen shillings; the vulcanite bottle and cup, for about eighteen shillings, can be got at Silver's, Cornhill; an ordinary tourist's "pocket pistol" might be less. The addition of these three, with a packet of cocoa or tin of beef-juice, with brandy, would not exceed two pounds extra."

### THE SIGNS OF DEATH.

Finally, I propose to allude briefly to the usual well-known *signs of death*, in deference to the expressed opinion of one of my critics, who considers that a knowledge of those signs which show a patient to be beyond medical aid "must prove not only important to the Ambulance man, but invaluable to other unfortunates who may be requiring his assistance."

When actual death takes place, as distinguished from only apparent death, the entire machinery of the body comes to a permanent stand-still, and the performance of the functions on which life depends ceases for ever.

There is *complete cessation of breathing*, not the slightest movement of the chest or abdomen being visible, no moist breath being exhaled to dim a looking glass placed before the mouth.

There is *complete cessation of the heart's action, and of the circulation*; no heart-beat can be felt on the left side of the chest near the nipple, neither can it be heard on placing the

ear on the chest in the same spot; no pulsation can be felt in the arteries of the wrist or elsewhere.

The eyes have lost their brightness, and look dim and glazed. "Who," says Caspar, "has ever lifted the eyelid of anyone just expired and not remarked this peculiar dull listless stare"? The eyes soon lose their prominence and become, ere long, flattened and collapsed.

"The whole body grows ashy-white," from the absence of circulation. And the hands, held in front of a strong light, look—for the same reason—opaque; whereas the hands of the living, under like conditions, appear translucent and red. Later on, the body is marked by livid discolorations in some parts, specially on its under surface, from stagnation of the blood in the capillaries.

The body becomes gradually cold; the time usually given for the cooling of the dead body to the temperature of the air is from fifteen to twenty hours, but this varies greatly according to the state of the corpse, and the surrounding circumstances.

"Immediately after death a general relaxation of the muscular system occurs," shown by the drooping eyelids, the drop of the lower jaw, the soft and flabby state of the limbs, and the suppleness of the joints; but in a few hours (usually about 5 or 6) the body becomes quite stiff and rigid. After lasting from about 16 to 24 hours, this stiffness and rigidity passes away, never to return.

The hands of the dead are partially closed, the thumbs being turned inwards towards the palms of the hands, beneath the half-bent fingers.

Lastly, the appearance of a green or greenish-blue discoloration of the abdomen, soon spreading to other parts of the body, marks the commencement of putrefaction.

As regards Drowning, Hanging, and Suffocation by foul gases, it is often difficult to ascertain whether the patient is really dead or not; for the body, though apparently dead, yet retains in some cases a lingering spark of life. So the bystanders, in such emergencies, should immediately make every effort to restore the patient, however hopeless the matter may at first appear. The following remarks by Dr. Alfred Swaine Taylor are very apt in these cases:—"Coldness and stiffness of the body in the drowned, should not prevent the application of means for the restoration of life. . . There is reason to believe that some persons removed from water in a state of apparent death are consigned to actual

death, owing to want of timely application of the means, and a want of perseverance in the treatment... some caution is required in pronouncing that a person is really dead (from drowning, hanging, or suffocation) since it at once discourages the efforts of those who are employing means for resuscitation. If the body has been for half an hour or longer under water, if it has been found hanging or in a suffocating medium and is cold and rigid, there can be no hope of resuscitation."





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